Vol. 34 No 8

BULLETIN

OF THE

TORREY BOTANICAL CLUB

AUGUST, 1907

Studies in North American Peronosporales—II. Phytophthoreae and Rhysotheceae

GUY WEST WILSON

The family *Peronosporaceae*, which includes all the genera of the order except *Albugo*, may be briefly characterized as follows: Mycelium intercellular; conidiophores aerial, variously branched; conidia borne singly at the apex of the ultimate branchlets of the coniophores, germinating by zoöspores or rarely by a germ-tube; oöspores globular, variously sculptured, germinating by a germ-tube.

Of the three well-defined tribes which constitute this family, the first two are discussed in this paper. It is usual to follow the older authors in considering the species embraced in the genera at present under discussion, as clearly distinguished from the remaining members of the family by the method of germination of the conidia, which in the *Phytophthoreae* and *Rhysotheceae* is normally by zoöspores, while those of the *Peronosporeae* germinate by means of a germ-tube. It is, however, well known that under certain conditions the conidia of these species do not throw out zoöspores, but produce one or more germ-tubes. This is probably due to conditions which cause the potential zoöspores, which are already formed within the conidium, to germinate before escaping from the conidial membrane.* With this real or apparent intergradation of characters, it is desirable to have a more stable basis for grouping the genera within the family. Characters which are much more easily observed and subject to less important variation are afforded by the conidiophores, the habit of branching of which conforms to the method of conidial germination.

*See Hartig, Unters. Forstbot. Inst. München 1: *pl. 3*.

[The BULLETIN for July, 1907 (34: 329–386, *pl. 24*) was issued 12 S 1907.]

Like many other plants, the *Peronosporaceae* do not lend themselves readily to characterization. The conidia vary greatly in size and often to a surprising extent in outline, and the conidiophores from their very nature are difficult of description. For this reason it appears desirable to add the heading "icones" under which as complete a list as practicable of illustrations in American works and the chief foreign ones is given for each species. A key to the genera is also given in which the three tribes are characterized and the genera under the first two included, the third tribe being reserved for future treatment.

A serious handicap in the treatment of the species of this family is the lack of information upon many points which are of taxonomic importance. While in America the present family has received more attention than almost any other group of *Phycomycetes*, a wide field for investigation is still open. The oöspores of many species are unknown, and even when known are of rare occurrence in herbaria; the germination of but few species has been studied in America, our knowledge on this point being frequently derived from European sources; the problems of oögenesis are practically untouched; but few inoculation experiments have been conducted to determine the range of hosts which a single species will affect. It is therefore apparent that a final, or even a reasonably satisfactory treatment of the group at the present time is impracticable.

In conclusion I wish to express my sincere appreciation of the courtesies shown me in my work, and especially to those botanists who have so kindly supplied me with material in addition to that which was available in preparing the previous paper of this series.

Conidiophores not clearly differentiated from the mycelium, scorpioid-cymosely branched; conidia germinating normally by zoöspores. PHYTOPHTHOREAE.
A single genus. 1. *Phytophthora*.
Conidiophores clearly differentiated from the mycelium.
Conidiophores monopodially branched, the branches usually arising at right angles to the main axis, successively shorter; conidia germinating normally by zoöspores. RHYSOTHECEAE.
Conidiophores with the main axis indurate above, the lateral branches reduced and basidium-like. 2. *Basidiophora*.
Conidiophores with the main axis not indurate above, the lateral branches developed normally.
Conidiophores fugaceous, stout, sparingly branched; oöspores permanently united to the walls of the oögone. 3. *Sclerospora*.

Conidiophores persistent, slender, usually freely branching; oōspores free from the walls of the oōgone.
Branches of the condiophore apically obtuse. 4. *Rhysotheca.*
Branches of the conidiophore apically acute. 5. *Pseudoperonospora.*
Condiophores dichotomously branched, the branches arising at right angles to the main axis, successively shorter; conidia germinating by a germ-tube. PERONOSPOREAE.

1. PHYTOPHTHORA de Bary, Jour. Roy. Agr. Soc. England II. **12**: 240. 1876

Mycelium much-branched, hyaline; conidiophores arising singly or in groups from the stomata, or breaking through the epidermis, branched or apparently simple, with irregular thickenings below the conidia, which are borne apically in a scorpoid cyme; conidia oval, papillate; zoōspores oval, biciliate, escaping by the rupture of the papilla; oōspores intramycelial, the epispore more or less ridged.

Type species, *Peronospora infestans* Casp.

Herbarium material of the species of this genus is very unsatisfactory for study, as the conidiophores form a very dense covering to the host, and being quite flaccid and often very long they form at maturity a dense felt in which the individual conidiophores are effectively obscured. This is especially true of *P. infestans*, while some of the foreign species are not difficult to study.

Key to the species

Conidia usually only one, rarely two, borne at the apex of an aborted cyme; conidiophore simple or branched below.
Host Fabaceae. 1. *P. Phaseoli.*
Host Araceae. 2. *P. Colocasiae.*
Conidia numerous in a simple or compound cyme.
Conidia sessile or long-stalked in a simple cyme.
Conidia small, about 35 μ. 3. *P. Nicotianae.*
Conidia large, 50μ, or more. 4. *P. Cactorum.*
Conidia sessile in a compound cyme.
Host Solanaceae. 5. *P. infestans.*
Host Ranunculaceae. 6. *P. Thalictri.*

1. PHYTOPHTHORA PHASEOLI Thaxter, Bot. Gaz. **14**: 274. 1889

The present species differs rather markedly from the other American species of the genus in the method of branching of the conidiophores, but in other respects they are quite similar. The conidiophores are very long, simple, or more commonly branched

at the base, and bear a single apical conidium, below which are several swellings of the conidiophore which indicate the typical cymosely branched conidiophore upon which the majority of conidia have failed to develop. This species, first described by Dr. Thaxter, has attracted the attention of various mycologists, among them Dr. Clinton, who has recently published a very complete discussion of this destructive parasite of the lima bean.* His article is accompanied by illustrations of the oöspores and a complete bibliography of the species.

ON FABACEAE:

Phaseolus lunatus L., Connecticut, *Clinton* (Fungi Columb. *1949*), *Rorer* (Funghi Par. Piant. Colt. *351*), *Thaxter* (Econ. Fungi *9*, N. Am. Fungi *2707*); Delaware, *Jackson 1554*.

TYPE LOCALITY: New Haven, Connecticut, on *Phaseolus lunatus* L.

DISTRIBUTION: Connecticut to Maryland. Also in European Russia.

ICONES: Rep. Conn. Agr. Exp. Sta. **1900**: *pl. 3. f. 29–37*; **1905**: *pl. 20–22*; Bull. N. J. Agr. Exp. Sta. **151**: 19. *f. 6*.

2. PHYTOPHTHORA COLOCASIAE Racib. Parasit. Algen u. Pilze Javas **1**: 9. 1900

This species, which is very closely related to *P. Phaseoli*, is said, by its author, to be very abundant on the taro, *Colocasia antiquorum*, throughout Java, but apparently not damaging the host. The fungus is to be expected in other tropical countries in which the host is cultivated.

3. PHYTOPHTHORA NICOTIANAE Van Breda de Haan, Meded. Lands Plant. **15**: 41. 1896

The present species, which is illustrated and described in great detail by its author, is a serious tobacco pest in the East Indies and may appear elsewhere at any time.

4. PHYTOPHTHORA CACTORUM (Lebert & Cohn) Schröter, in Cohn, Krypt. Fl. Schles. **3**[1]: 274. 1886

Peronospora Cactorum Lebert & Cohn, Beitr. Biol. Pflanz. **1**[1]: 56. 1870.

*Ann. Rep. Conn. Agr. Exp. Sta. **1905**: 278–303. *pl. 20–22*. 1906.

Phytophthora omnivora de Bary, Bot. Zeit. **39**: 584, 619. *pl. 5. f. 33–41.* 1881.

This species has long been a scourge in Europe on account of its attacks upon seedlings and succulents, its hosts including representatives of fifteen families ranging from *Pinaceae* to *Scrophulariaceae*. Until quite recently this species was not reported from other countries, its first record from foreign quarters being in connection with a serious outbreak of a pod-rot of cacao in the island of Trinidad.* Material was sent to Massee, who identified one of the fungi concerned as *Phytophthora omnivora* de Bary. His description † is of a popular nature and would apply equally well to any one of several groups of fungi, while his figures are unmistakably of a species of *Phytophthora* of the same type as the present one. The conidia are somewhat more elongate and attenuate than usual. This, taken with the habitat, suggests that the pod-rot of the cacao may be caused by a distinct but closely related species, but no definite statement can be made without first examining fresh material. Since the first report of the outbreak of the disease, it has been reported from various other localities in the West Indies, South America, Asia and Africa. The history, distribution and nature of the disease are fully discussed by Howard.‡ The species is also included by Freeman in his Minnesota Plant Diseases § as a pest in seed-beds.

5. PHYTOPHTHORA INFESTANS (Mont.) de Bary, Jour. Roy. Agr. Soc. England II. **12**: 240. 1876

Botrytis infestans Mont. Mém. Inst. France **1845**: 313. 1845.
Peronospora infestans Casp. in Rabenh. Herb. Viv. Myc. I. *1879.* 1854.

As one of our worst plant diseases is caused by the present species its distribution is rather well worked out. While the fungus is not so prevalent, except in localities where the potato is cultivated in large commercial quantities, the range of both appears to be coextensive. It is, however, much more destructive in the

* Hart, Bull. Trinidad Bot. Gard. **3**: 167–169. Ja 1899.
† Kew Bull. Misc. Inf. **1899**: 1–6. *plate.* 1899.
‡ West Indian Bull. **2**: 190–211. 1901.
§ Page 382. 1905.

northern than in the southern states, as it requires a cool, moist atmosphere in which to develop to the best advantage. Besides the potato, which is its chief host, the fungus attacks numerous other species of the genus *Solanum* as well as members of various other genera of *Solanaceae*.

ON SOLANACEAE:

Solanum tuberosum L., Connecticut, *Clinton* (Fungi Columb. *1839*); Illinois, *Burrill*, *Seymour* (N. Am. Fungi *2204*); Iowa, *Blackwood*, *Buchanan*, *Holway*, *Pammel*; New York, *Ellis* (Fungi Carol. **5**: *92*), *Whetzel*; Tennessee, *Scribner* (Econ. Fungi *447*); Vermont, *Jones*; Wisconsin, *Pammel*, *Trelease*.

Lycopersicon Lycopersicon (L.) Karst., Delaware, *Smith* (Fungi Columb. *2138*); South Carolina, *Ravenel* (Myc. Univ. *926*).

TYPE LOCALITY: France, on *Solanum tuberosum* L.

DISTRIBUTION: Eastern Canada to California and Florida. Also in South America, Europe, Asia, Africa, and Australia.

ICONES: Bot. Zeit. **5**: *pl. 6. f. 1–6*; Bull. Bussey Inst. **1**: 319. *fig.*; Bull. Ill. Lab. Nat. Hist. **1**[1]: *pl. 2. f. 8–10*; Frank, Lehrb. Bot. **2**: 114. *f. 321*; Rep. U. S. Dep. Agr. **1888**: *Veg. Path. pl. 1, 2*; Rep. Maine Agr. Exp. Sta. **1889**: 172. *f. 1–10*; Rep. Vt. Agr. Exp. Sta. **1890**: 132. *fig.*; Rep. N. J. Board Agr. **17**: *pl. 4*; v. Tubeuf, Pflanzenkrankheiten 142. *f. 31*; Bull. Calif. Agr. Exp. Sta. **175**: *f. 3, 6–8*; Berlese, Icon. Fung. Phyc. *pl. 8*.

6. **Phytophthora Thalictri** Wilson & Davis

Hypophyllous, the infested area suborbicular or irregular in outline, appearing somewhat glaucous; epiphyllous discoloration very dark, almost black, sometimes with a distinct brownish margin; conidiophores fasciculate from the stomata, continuous, lax and somewhat flexuose, rather scattered on the infested area and not forming a dense felt, 300–400 × 5–7 μ, bearing usually 1 or 2 branches, subconidial swellings narrowly conical, less than twice as thick as the branch; conidia elliptic, apically papillate, 20–27 × 13–17 μ; oöspores unknown.

Type collected by Dr. J. J. Davis, June 20, 1907, in Kenosha County, Wisconsin, on *Thalictrum purpurascens* L.

Distinguished from *P. infestans* by the more pronounced dis-

coloration of the infested area and the less disastrous effect on the host; the shorter and more slender conidiophores which form a sparse covering to the infested area instead of forming a dense felt as in the other American species, and which are more persistent than is common in the genus; the slightly smaller and more elongate conidia. The material collected by Dr. Davis was all on a single plant of the host which is rather common in that region. Specimens of the type collection are in the herbaria of Dr. Davis, of the New York Botanical Garden, and of the author.

2. BASIDIOPHORA Roze & Cornu, Ann. Sci. Nat. V. 11: 84. 1869

Mycelium much-branched; conidiophores clavate, the apex an enlarged indurate axis upon which short, simple, cylindric lateral branches are borne alternately; conidia ovate to globose-ovate, smooth, hyaline, apically papillate, breaking away with a portion of the branch attached; zoöspores biciliate, monoplanal; oöspores produced in the tissues of the host in company with the conidiophores; epispore yellowish-brown, more or less irregularly ridged.

Type species, *Basidiophora entospora* Roze & Cornu.

The species of this genus are easily recognized by the clavate conidiophore with its short cylindric fertile branches. The only approach to this type of branching among the other members of the tribe is in the monotypic Japanese genus *Kawakamia* Miyabe, which is described as having the conidiophores "simple or sometimes branched without any order, generally only once and that not from the base of the conidium, slender and provided generally at the tip with a short pedicel-cell, which is more slender than the conidiophore," which is "swollen at base, and gradually tapering toward the tip."*

Key to the species

Conidiophores tall, reaching 300μ; conidia ovate; oöspores with prominent ridges. 1. *B. entospora.*

Conidiophores short, not over 100μ; conidia globose-ovate; oöspores with very obscure ridges. 2. *B. Kellermanii.*

1. BASIDIOPHORA ENTOSPORA Roze & Cornu, Ann. Sci. Nat. V. 11: 84. 1869

Peronospora entospora Berk. & Br. Grevillea 1: 20. 1872.

* Bot. Mag. Tokyo 17: (306). 1903.

Peronospora simplex Peck, Ann. Rep. N. Y. State Mus. Nat. Hist. **31**: 45. 1879.

Plasmopara entospora Schröt. in Cohn, Krypt. Fl. Schles. **3**[1]: 237. 1886.

Hypophyllous, forming angular areas 1–8 mm. across, bounded by the veins of the leaf; conidiophores arising from the stomata, singly or in groups, hyaline, 150–300 × 8–20 μ, apically much enlarged, 17–25 μ, lateral branches 5–20, about 6–10 × 2 μ; conidia ovate, 20–36 × 10–20 μ; oöspore light yellowish-brown, 40–50 μ; epispore conspicuously ridged.

ON CARDUACEAE:

Aster Novae-Angliae L., Indiana, *Wilson;* Wisconsin, *Trelease* (N. Am. Fungi *1405*).

Aster oblongifolius Nutt., Nebraska, **Bates* (Fungi Columb. *1950*).

Erigeron philadelphicus L., Louisiana, *Langlois 1669.*

Erigeron ramosus (Walt.) B. S. P., Illinois, *Earle, Waite.*

Leptilon canadense (L.) Britton, Missouri, **Pammel.*

Solidago rigida L., Illinois. * *Seymour* (N. Am. Fungi *1405b*, Fungi Europ. *3277*).

Reported also from our limits on *Aster sagittifolius* Willd. and *Rudbeckia fulgida* Ait.

TYPE LOCALITY: France, on *Leptilon canadense* (L.) Britton.

DISTRIBUTION: New York to Wisconsin, Nebraska, Texas, and Alabama. Also in Europe and South America.

ICONES: Ann. Sci. Nat. V. **11**: *pl. 4;* Rabenh. Krypt. Fl. ed. 2. **1**[4]: 424. *f. 68;* Berlese, Icon. Fung. Phyc. *pl.* 7.

2. **Basidiophora Kellermanii** (Ellis & Halsted).

Peronospora Kellermanii Ellis & Halsted "*pro tem.*"; Ellis & Everh. N. Am. Fungi *2201.* 1889. (Hyponym.)

Plasmopara sp. Swingle, Trans. Kan. Acad. Sci. **11**: 74. 1889.

Plasmopara Kellermanii Swingle; Sacc. Syll. Fung. **9**: 342. 1891.

Hypophyllous, forming angular discolored patches which often cover a large portion of the leaf; conidiophores arising from the stomata, singly or in groups, very short, hyaline, 25–100 × 8–10 μ, apically much enlarged, about 15–20 μ; lateral branches 4–7, short, 5–8 × 2 μ; conidia globose-ovate, 20–22 × 18–20 μ; oöspores yellowish-brown, obscurely ridged, 30–40 μ.

This species has an interesting history, and, while known for some years, it has never been fully described. That it is abundant in those localities where it occurs is evidenced not only by the quotation below, but by the additional fact that in three instances material has been collected in sufficient quantity for distribution in exsiccati. The original collection was distributed in North American Fungi *2201*, where it received its first name. A description was drawn at the same time by Dr. Halsted, to whom the material was submitted for determination, but this is still unpublished. Swingle's note on the species forms the basis of the diagnosis in Saccardo's *Sylloge Fungorum* and is as follows:

"This species has not yet been published, but seems to be a *Plasmopara* allied to *P. entospora*, from which it differs in having shorter fasciculate conidiophores and almost sessile conidia, which are smaller than in some forms of *P. entospora*. It is a very abundant and curious species, as yet little understood."

In addition to these points of difference attention should be called to the more globular conidia, the darker oöspores with their less conspiciously ridged epispore, and the larger infested area with more pronounced discoloration of the host in the present species than in the former.

ON AMBROSIACEAE:

Iva xanthiifolia Nutt., Kansas, **Bartholomew* (Fungi Columb. *1841*), **Kellerman* (N. Am. Fungi *2201*); Nebraska, **Pammel*, **Sheldon;* North Dakota, **Seaver;* South Dakota, **Griffiths* (W. Am. Fungi *191*); Wyoming, **Pammel & Stanton.*

TYPE LOCALITY: Manhattan, Kan., on *Iva xanthiifolia* Nutt.

DISTRIBUTION: North Dakota and Wyoming to Kansas.

ICON: Freeman, Minn. Pl. Diseases 111. *f. 45.*

3. SCLEROSPORA Schröter; de Bary, Bot. Zeit. **39**: 621. 1881

Peronospora § *Sclerospora* Schröter, Hedwigia **18**: 86. 1879.

Mycelium much branched, with small vesicular haustoria; conidiophores erect, solitary or in groups of 2–3, fugaceous, low and stocky, sparsely branched, the branches also stocky; conidia elliptic or globose-elliptic, hyaline, smooth; oöspores intramycelial,

the epispore brown, irregularly wrinkled, permanently united to the persistent wall of the oögonium.

Type species, *Protomyces graminicola* Sacc.

Key to the species

Oöspore small, 26–36 μ; epispore not pronouncedly opaque; host, *Chaetochloa*.	1. *S. graminicola*.
Oöspore large, 28–45 μ; epispore very opaque; host, *Chloris*.	2. *S. Farlowii*.

1. SCLEROSPORA GRAMINICOLA (Sacc.) Schröter, in Cohn, Krypt. Fl. Schles. **3**[1]: 236. 1886

Protomyces graminicola Sacc. Nuovo Giorn. Bot. Ital. **8**: 172. 1876.

Peronospora graminicola Schröter, in Zopf & Sydow, Myc. March. 9. 1881.

Peronospora graminicola Setariae-italicae Traverso, Bull. Soc. Bot. Ital. **1902**: 168. *f. 1–3*. 1902.

Infesting leaves and inflorescence, causing marked distortion of the latter and, in the case of oöspores, the rapid disintegration of the former; conidiophores 100 × 10–12 μ; conidia 20 × 15–18 μ: oögone-wall thick, 4–12 μ, at maturity 30–60 μ diam., reddish-brown; oöspore pale-brown, 26–36 μ.

The conidiophores of this species are very stout and quite unlike those of any other American species of the order. Their very ephemeral character has caused them to be overlooked by collectors, while the reddish-brown color given to the leaves by the oöspores renders them rather conspicuous objects. As a result herbarium material of this species is rich in oöspores while the conidia are rare. The variety on *Chaetochloa italica* is described as having much larger oöspores than does the typical form, but an examination of American as well as authentic foreign material upon this host failed to show any constant or appreciable difference between the material upon this and upon the other hosts of the species.

ON POACEAE:

Chaetochloa italica (L.) Scribn., Iowa, * *Halsted;* Michigan, *Wheeler;* Wisconsin, * *Pammel.*

Chaetochloa viridis (L.) Scribn., Iowa, *Carver 13*, * *Halsted* (N. Am. Fungi *1803a*), * *Hitchcock*, * *Pammel* (Econ.

Fungi *64*); Minnesota, * *Pammel;* Nebraska, * *Bates* (Fungi Columb. *1776*): South Dakota, * *Griffiths* (W. Am. Fungi *8*); Wisconsin, *Trelease* (N. Am. Fungi *1803b*).

TYPE LOCALITY: Selva, Italy, on *Chaetochloa verticillata* (L.) Scribn.

DISTRIBUTION: Vermont to South Dakota and Kansas. Also in Europe and Asia.

ICONES: Bot. Gaz. **11**: *pl. 8;* Rabenh. Krypt. Fl. ed. 2. **1**[4]: 438. *f. 71;* Fl. Nebr. **1**: *pl. 16. f. 4;* Berlese, Icon. Fung. Phyc. *pl. 9. f. 1;* Bull. Soc. Bot. Ital. **1902**: 169. *f. 1–3;* Bot. Mag. Tokyo **11**: *pl. 2.*

2. SCLEROSPORA FARLOWII Griffiths, Bull. Torrey Club **34**: 207. 1907

Infected areas on the leaf-sheaths, rarely on the leaf-blades, irregular in outline, usually elongate, brownish with a darker border, up to 10 mm. or more in length; conidiophores unknown; oöspores globose, 28–45 μ; epispore slightly wrinkled, very opaque, reddish-brown, often appearing almost black.

Through the courtesy of Dr. Griffiths, material from the type locality was available for examination. This species is very distinct from *S. graminicola*, from which it differs in the slightly larger and more opaque oöspore with its lighter and smoother epispore. The disintegrating influence of the fungus upon the host is also absent in the present species, while in *S. graminicola* this is very pronounced.

ON POACEAE:

Chloris elegans H. B. K., Arizona, *Griffiths.*

TYPE LOCALITY: Cochise, Arizona, on *Chloris elegans* H. B. K.

DISTRIBUTION: Arizona and Sonora.

Species Inquirendae

Three additional species, of which the conidiophores are unknown, have been referred to this genus. The oöspores differ from those of *S. graminicola* in their lighter color, the thinner epispore, the difficulty of freeing them from the tissues of the host in which they are imbedded, and the failure of the affected leaves to liberate the oöspores by the rapid disintegration of the tissues

of the host. That these species are members of the present order is doubtful; and if they are, it is still more improbable that they are congeneric with the American species.

S. Magnusiana Sorokin, Rev. Myc. **11**: 143. 1889. On *Equisetum* sp., in the region of the southern Ural Mountains of Russia.

S. macrospora Sacc. Hedwigia **29**: 155. 1890. On *Alopecurus* sp. in Australia, and *Triticum vulgare* L., in Europe.

S. Kriegeriana Magnus, Verh. Deutsch. Naturf. **67**: 100. 1895. On *Phalaris arundinacea* L., in Europe.

4. **RHYSOTHECA** gen. nov.

Peronospora § *Zoosporatoparae* de Bary, Ann. Sci. Nat. IV. **20**: 105. 1863.

Mycelium branching; haustoria simple; condiophores erect, solitary or fasciculate, projecting through the stomata of the host, monopodially branched, the branches usually arising at right angles to the main axis, as do also the secondary branches, at least never appearing truly dichotomous, the ultimate branches apically obtuse; conidia globose to ovoid, hyaline, germinating directly by zoöspores; oöspores yellowish-brown, the epispore variously wrinkled, sometimes appearing somewhat reticulate; oögonium persistent but free from the oöspore. (Etymology, *ῥυσός*, wrinkled, *θήκη*, casket.)

Type species, *Peronospora viticola* (B. & C.) Casp.

To this genus belong the greater number of species which are usually referred to *Plasmopara*. That they are closely related to the preceding genera is evidenced by the habit of branching of the conidiophores and the germination of the conidia by zoöspores. *Plasmopara, sensu stricto*, has conidiophores with the ultimate branchlets apically obtuse as in the present genus, but with the general method of branching more nearly dichotomous than monopodial, and with the conidia germinating in a decidedly anomolous manner. The membrane breaks as in the present genus and the entire protoplasmic content escapes in a mass, forming a non-motile plasma from which a germ-tube is produced. That this is not the typical method of germination either for the *Rhysotheceae* or the *Peronosporeae* is evident, and unless the formation of a plasma be construed as the equivalent of zoöspore-formation the

genus cannot stand under the present tribe. That the method of germination is more nearly analogous to that of the *Peronosporeae* is the view held by the present author. The genus *Rhysotheca* is therefore the most highly developed and the typical genus of the group of genera the conidia of which germinates by zoōspores, while *Plasmopara* stands in the same relation to *Peronospora* as does *Pseudoperonospora* to *Rhysotheca*.

Key to the species

Conidiophores low, averaging 300 μ or less, 2–3 times branched, the branches short. 1. *R. Geranii.*

Conidiophores tall, averaging over 300 μ, 2–5, usually 4 or 5, times branched, the branches long.

Ultimate branchlets elongate, cylindric.

Primary branches short, densely branched. 2. *R. Umbelliferarum.*

Primary branches elongate, lax.

Conidiophores 3–4 times branched.

Conidia small, about 15×17 μ. 3. *R. Epilobii.*

Conidia large, about 27×35 μ. 4. *R. Heliocarpi.*

Conidiophores 4–5 times branched, very lax. 5. *R. obducens.*

Ultimate branchlets more or less conic.

Ultimate branchlets broadly truncate.

Secondary branchlets very short. 6. *R. Halstedii.*

Secondary branchlets lax.

Secondary branchlets sparingly branched.

Conidia about 12×15 μ. 7. *R. australis.*

Conidia about 15×18 μ. 8. *R. illinoensis.*

Secondary branchlets much branched; conidia about 14×22 μ. 9. *R. viticola.*

Ultimate branchlets narrowly truncate.

Conidia elliptic, about 15–20 μ long.

Conidiophores 2–4 times branched. 10. *R. Viburni.*

Conidiophores 3–5 times branched. 11. *R. ribicola.*

Conidia globose-elliptic, about 18–30 μ long. 12. *R. Gonolobi.*

1. **Rhysotheca Geranii** (Peck)

Peronospora Geranii Peck, Rep. N. Y. State Mus. Nat. Hist. **28**: 63. 1876.

Peronospora nivea Geranii Farlow; Ellis, N. Am. Fungi *218*. 1879.

Plasmopara Geranii Berl. & De-Toni, in Sacc. Syll. Fung. **7**: 248. 1888.

Hypophyllous; infected areas conspicuous, definite in outline, or often covering the entire leaf, white-downy; conidiophores fasciculate, monopodially 2–3 times branched, the branches short

and with the exception of the lowest rarely with well developed secondary branches, 90–350 × 9–12 μ; conidia obovoid, basally papillate, hyaline, 18–25 × 12–15 μ; oöspores surrounded by periplasm at maturity, 25–35 μ; oögone persistent, wrinkled, yellowish-brown, as is also the epispore.

In Europe two other members of the order occur upon species of *Geranium*, but so far they have not been recorded from America nor has the present species been found abroad. The material issued under this name by Allescher and Schnabel in their Fungi Bavarici *555* is *Plasmopara pusilla*, a much smaller species with almost simple conidiophores. Neither of these species is as large as *Peronospora conglomerata* Fuckel. The mycelium, according to Dr. Halsted,* is perennial.

ON GERANIACEAE:

Geranium carolinianum L., Alabama, *Carver 150, Earle, Underwood;* Georgia, *Underwood 2242a;* Illinois, *Earle, Pammel, *Seymour* (Fungi Europ. *3176*, N. Am. Fungi *1404*); Indiana, *Arthur, Underwood* (Econ. Fungi *A3*, Indiana Fl. *100*); Mississippi, *Tracy;* Missouri, *Galloway, Pammel, Trelease;* New Jersey, *Ellis, Fairchild;* North Carolina, *Stevens.*

Geranium dissectum L., Mississippi, *Tracy* (Fungi Columb. *405*, on "*Geranium carolinianum*").

Geranium maculatum L., District of Columbia, *Galloway 1357;* Indiana, *Olive;* Massachusetts, *Farlow* (N. Am. Fungi *218*); New York, *Jackson 1154, Thom;* Ontario, *Dearness* (Fungi Columb. *2048*); West Virginia, *Sheldon;* Wisconsin, *Davis, Pammel.*

Geranium pusillum L., Louisiana, *Langlois 942;* South Carolina, *Rolfs 1689.*

? Geranium Richardsonii Fisch. & Traut., Wyoming, *Pammel & Stanton.*

This species has also been reported from our limits on *Geranium Robertianum* L.

TYPE LOCALITY: North Greenbush, N. Y., on *Geranium maculatum* L.

---

* Bot. Gaz. 15: 321. 1890; 16: 338. 1891.

DISTRIBUTION: Massachusetts to Wyoming, Texas, and Georgia.

ICON: Berlese, Icon. Fung. Phyc. *pl. 12.*

2. **Rhysotheca Umbelliferarum** (Caspary)

Botrytis nivea Mart.; Unger, Exanth. 171. 1833. Not *B. nivea* Mart. 1817.

Botrytis macrospora Ditmar; Unger, Exanth. 173. 1833. Not *B. macrospora* Ditmar 1817.

Peronospora macrocarpa Rabenh. Herb. Viv. Myc. I. *1172.* 1846. Not *P. macrocarpa* Corda 1842.

Peronospora nivea Unger, Bot. Zeit. **5**: 314. 1847. Not *Botrytis nivea* Mart. 1817.

Peronospora macrospora Unger, Bot. Zeit. **5**: 315. 1847. Not *Botrytis macrospora* Ditmar 1817.

Peronospora Conii Tul. Compt. Rend. Acad. Paris **38**: 1103. 1854. (Nomen nudum.)

Peronospora Umbelliferarum Caspary, Monatsb. K. Preuss. Akad. Wiss. **1855**:—(23). 1855.

Plasmopara nivea Schröt. in Cohn, Krypt. Fl. Schles. **3**[1]: 237. 1886. Not *Botrytis nivea* Mart. 1817.

This species is included by Harkness and Moore in their *Pacific Coast Fungi* as having been collected in the region of San Rafael, Calif., on an undetermined species of *Umbelliferae.* Since then no new record of the species in North America has appeared. That the fungus is rather widely distributed on our continent is not impossible as it infests a wide range of Umbelliferous hosts, several of which are either wild or cultivated in various parts of America. A good illustration of the species is given by Berlese.*

3. **Rhysotheca Epilobii** (Otth)

Peronospora Epilobii Otth, Bern. Mitth. **1868**: 63. 1868.

Plasmopara Epilobii Schröt. in Cohn, Krypt. Fl. Schles. **3**[1]: 238. 1886.

This species is rather widely distributed in Europe on various species of *Epilobium,* but so far has not been recorded from America. It is illustrated by Berlese.†

---

*Icon. Fung. Phyc. *pl. 18.*

†Icon. Fung. Phyc. *pl. 14.*

4. **Rhysotheca Heliocarpi** (Lagerh.)

Plasmopara Heliocarpi Lagerh.; Pat. & Lagerh. Bull. Soc. Myc. France **8**: 123. 1892.

This species is known only from the type locality in Ecuador, where it occurs on the leaves of *Heliocarpus americanus* L. According to Dr. Rose * the host name as given in the original description has been applied very loosely to various members of the Tiliaceous genus *Heliocarpus*, the species of which are widely distributed in tropical America. It is, therefore, not improbable that the fungus is of more than local occurrence and that it infests several hosts.

5. **Rhysotheca obducens** (Schröt.)

Peronospora obducens Schröt. Hedwigia **16**: 129. 1877.

Plasmopara obducens Schröt. in Cohn, Krypt. Fl. Schles. **3**[1]: 238. 1886.

Peronospora Impatientis Ellis & Everh. Proc. Acad. Nat. Sci. Phila. **1891**: 86. 1891.

Plasmopara Impatientis Berlese, Icon. Fung. Phyc. 15. 1898.

Hypophyllous, usually on the cotyledons, the affected area irregular in outline, following the veins, or covering the entire surface of the leaf, white-cottony; conidiophores fasciculate, 2–4 from a stoma, slender, 300–500 × 7–12 μ, flexuosely branched, the branches usually 4–5 times branched, ultimate branchlets about 6–9 μ long; conidia broadly ellipsoid, 12–14 × 12–21 μ; oöspores light yellowish-brown, 25–30 μ; epispore slightly wrinkled, or smooth; oögone 40–50 μ.

In his monograph Berlese recognizes both *Plasmopara obducens* and *P. Impatientis* as valid species, due apparently to a misinterpretation of the original description of the latter species. In this the height of the unbranched portion only of the conidiophore is given. Otherwise the descriptions of the two species tally as closely as could be expected. Nor is this resemblance accidental, as the type of *Peronospora Impatientis* shows no perceptible points of difference from European material of *P. obducens* which was determined by Schröter himself.

---

* Cont. U. S. Nat. Herb. **8**: 315. 1905.

ON BALSAMINACEAE:

Impatiens aurea Muhl., Alabama, *Earle & Underwood;* Indiana, *Arthur*; Iowa, *Holway.*

Impatiens biflora Walt., Connecticut, *Underwood 2981*; Delaware, *Commons* (type of *Peronospora Impatientis* Ellis & Everh.) *Jackson 1572;* District of Columbia, *Williams;* Indiana, *Olive, Underwood, Wilson;* Massachusetts, *Farlow, Halsted & Farlow* (N. Am. Fungi *207*), *Seymour* (Econ. Fungi *A7a*, on "*Impatiens* sp."), *Trelease;* Michigan, *Merrow* (Econ. Fungi *A7b*, on "*Impatiens* sp."); New York, *Dudley & Underwood;* Wisconsin, *Davis, Pammel.*

Impatiens sp., West Virginia, *Sheldon.*

TYPE LOCALITY: Rastatt, Germany, on *Impatiens Nolitangere* L.

DISTRIBUTION: Vermont to Minnesota, southward to Alabama. Also in Europe.

ICON: Berlese, Icon. Fung. Phyc. *pl. 15.*

6. **Rhysotheca Halstedii** (Farl.)

Peronospora Halstedii Farl.; Ellis, N. Am. Fungi *209.* 1879. (Hyponym); Proc. Am. Acad. **18**:72. 1883.

Peronospora Halstedii Ambrosiae Ellis, N. Am. Fungi *210.* 1879. (Hyponym.)

Plasmopara Halstedii Berl. & De-Toni, in Sacc. Syll. Fung. **7**: 242. 1888.

Hypophyllous, on cotyledons and leaves, the affected area small, 1–3 mm., or extending over the entire leaf; conidiophores fasciculate, slender, 300–750 μ, 3–5 times branched, ultimate branchlets ·8–15 μ long, verticillate below the apex of the branching axis which is frequently swollen and ganglion-like; conidia oval or elliptic, 18–30 × 14–25 μ; oöspores 30–32 μ; epispore yellowish-brown, somewhat wrinkled.

This is the most unsatisfactory species of a difficult genus. The conidiophores are very variable, especially in the laxity of their branches and the development of the ganglion-like swelling from which the ultimate branchlets arise. Several forms are clearly distinguishable and are apparently valid species, but further search has invariably brought to light intermediate forms connecting the extremes with the typical form and with other forms. Until an

exhaustive study of a much greater quantity of material, both conidial and oösporic, is possible than is at present at hand, segregation of this species had best not be attempted. The extreme forms are found on *Eupatorium*, with but few branches with the ganglion-like structure, and on *Helianthus*, where the converse is true.

ON AMBROSIACEAE:

Ambrosia artemisiaefolia L., Iowa, *Arthur, Hitchcock;* Massachusetts, *Farlow* (N. Am. Fungi *210*); Missouri, *Demetrio;* Wisconsin, *Pammel.*

Ambrosia psilostachya DC., Kansas, *Bartholomew* (Fungi Columb. *1563*).

Ambrosia trifida L., Kansas, *Kellerman* (N. Am. Fungi *1403d*); New York, *Jackson 1129;* Missouri, *Pammel.*

ON CARDUACEAE:

Bidens cernua L., Vermont, *Grout.*

Bidens frondosa L., Alabama, *Carver 173;* Illinois, *? Pammel;* Indiana, *Wilson;* Iowa, *Arthur, Bessey, Hitchcock;* Kansas, *Swingle 963;* Michigan, *Merrow* (Econ. Fungi *298*); Mississippi, *Tracy;* Nebraska, *Bates* (Fungi Columb. *2257*); Ontario, *Dearness;* Wisconsin, *Davis, Pammel.*

Bidens laevis (L.) B. S. P., Iowa, *Bessey.*

Erechtites hieracifolia (L.) Raf., Illinois, *Waite;* New Jersey, *Halsted* (Econ. Fungi *308 a*); Massachusetts, coll. ign. (Econ. Fungi *308 b*); Wisconsin, *Davis.*

Erigeron annuus (L.) Pers., Wisconsin, *Davis* (as *E. Philadelphicus* Willd.).

Eupatorium ageratoides L. f., Wisconsin, *Pammel.*

Eupatorium purpureum L., Iowa, *Bessey* (N. Am. Fungi *209*); Michigan, *Merrow.*

Gnaphalium spathulatum Lam., Mississippi, *Earle.*

Gnaphalium purpureum L., Alabama, *Atkinson* (Econ. Fungi *314*).

Helianthus annuus L., District of Columbia, *Scribner;* Indiana, *Arthur, Thomas;* Ohio, *Kellerman* (Ohio Fungi *68*, on "*Vitis* sp.," later corrected); Ontario, *Dearness* (Fungi Columb. *132*); Wisconsin, *Pammel.*

Helianthus divaricatus L., Wisconsin, *Pammel, Trelease.*

Helianthus doronicoides Lam., Iowa, *Arthur;* Kansas, *Kellerman* (Fungi Europ. *3278*, N. Am. Fungi *1403 c*).

Helianthus grosseserratus Martens, Iowa, *Hitchcock, Macbride;* Nebraska, *Sheldon.*

Helianthus hirsutus Raf., Missouri, *Pammel.*

Helianthus Maximiliani Schrad., Iowa, * *Pammel.*

Helianthus occidentalis Riddell, Wisconsin, *Pammel.*

Helianthus scaberrimus Ell., Nebraska, *Bates* (Fungi Columb. *2139*).

Helianthus strumosus L., Minnesota, *Arthur;* Wisconsin, *Davis.*

Helianthus tuberosus L., Pennsylvania, *Ellis* (N. Am. Fungi *1403 a*); Wisconsin, *Farlow, Pammel.*

Helianthus sp., New York, *Thom;* Missouri, *Galloway* (on "*Vernonia noveboracensis*"); Wisconsin, *Davis.*

Rudbeckia laciniata L., Nebraska, *Sheldon;* North Dakota, *Seymour;* Wisconsin, *Davis, Pammel.*

Rudbeckia triloba L., Illinois, *Hart.*

Silphium integrifolium Michx., Kansas, *Kellerman* (Fungi Europ. *3279*); Nebraska, *Sheldon;* Wisconsin, *Davis, Pammel.*

Silphium laciniatum L., Iowa, *Arthur.*

Silphium perfoliatum L., Iowa, *Bessey;* Minnesota, *Pammel;* Missouri, *Pammel;* Nebraska, *Sheldon;* Wisconsin, *Davis, Tracy.*

Silphium terebinthinaceum Jacq., Illinois, *Pammel;* Wisconsin, *Davis, Pammel, Trelease* (N. Am. Fungi *1403 b*).

Verbesina encelioides (Cav.) A. Gray, New Mexico, *F. S. & E. S. Earle 172.*

The following additional hosts are reported from our limits: *Artemisia ludoviciana* Nutt., *Bidens comosa* (A. Gray) Wiegand, *B. connata* Muhl., *Centaurea* sp., *Helianthus trachaelifolius* Willd., *Iva xanthiifolia* (Fres.) Nutt., *Madia sativa* Molina, *Silphium trifoliatum* L., *Solidago canadensis* L., *S. Riddellii* Frank, *Vernonia Baldwinii* Torr., *V. noveboracensis* (L.) Michx., and *Xanthium canadense* Mill. Of these two are somewhat doubtful, as it is quite probable that the record of *Iva* as a host refers to *Basidiophora Kellermanii*, while a part of the material which served as the

basis for the citation of *Vernonia noveboracensis* as a host has been examined and instead of that species the host is some *Helianthus*, but as the leaves seen were all very young it is impossible to determine the species.

TYPE LOCALITY: Jamaica Plain, Massachusetts, on *Eupatorium purpureum* L.

DISTRIBUTION: Vermont to North Dakota, California, and Alabama. Also in Europe.

ICONES: Fl. Nebr. **1**: *pl. 16. f. 5;* Berlese, Icon. Fung. Phyc. *pl. 20.*

7. **Rhysotheca australis** (Speg.)

Peronospora australis Speg. Anal. Soc. Ci. Argent. **12**: 36. 1881.
Peronospora sicyicola Trel.; Farlow, Bot. Gaz. **8**: 331. 1883.
Plasmopara australis Swing. Trans. Kan. Acad. Sci. **11**: 72. 1889.

Hypophyllous, the infected area amphigenously discolored, of variable size and shape, bounded by leaf-veins; conidiophores fasciculate, arising from the stomata of the host, 500–650 × 9–11 μ, with 5–7 main branches, the branches monopodially 3–4 times branched, the ultimate branchlets 10–14 μ long; conidia widely ellipsoid, 14–17 × 10–13 μ; mature oöspores unknown.

This species is very distinct in habit as well as in other important characters from *Pseudoperonospora cubensis*, with which European mycologists have sometimes confused it. The mature oöspores are unknown, but the immature ones are described as almost hyaline and with a smooth epispore, 30–40 μ.*

ON CUCURBITACEAE:

Micrampelis lobata (Michx.) A. Gray, Kansas, *Bartholomew* (Fungi Columb. *2334*).

Sicyos angulatus L., Illinois, *Clinton, Pammel, Seymour* (Econ. Fungi *42*, Fungi Europ. *3276b*); Indiana, *Olive, Wilson*; Kansas, *Kellerman* (Fungi Europ. *3276a*); Missouri, *Galloway;* Nebraska, *Bartholomew* (Fungi Columb. *2556*); New York, *Jackson 1150, Thom;* Ohio, *Kellerman* (Ohio Fungi *147*); Ontario, *Dearness;* Wisconsin, *Pammel, Trelease* (Fungi Gallici *3421*, N. Am. Fungi *1416*).

TYPE LOCALITY: Recoleta, Argentina, on *Cyclanthera Hystrix* Arn.

* Swingle, *l. c.*

DISTRIBUTION: Massachusetts to Ontario, Wisconsin, Kansas, and Ohio. Also in South America.

ICONES: Rep. Mass. State Agr. Exp. Sta. **8**: *pl. 2. f. 15, 16*; Rev. Myc. **22**: *pl. 203. f. 10, 11*; Berlese. Icon. Fung. Phyc. *pl. 16*.

8. **Rhysotheca illinoensis** (Farl.)

Peronospora illinoensis Farl. Bot. Gaz. **8**: 332. 1883.

Hypophyllous; infected area irregular in outline, up to 10 mm., densely cottony, epiphyllous discoloration slight or none; conidiophores fasciculate, about 500 × 10 μ, with 2–4 main branches which are 2–4 times laxly branched, the ultimate branchlets 10–12 μ long, subacute; conidia elliptic, 15–18 × 17–20 μ; oöspores unknown.

This species is known only from the collections of Professor Seymour at Camp Point and Quincy, Illinois. The inconspicuous habit of the fungus and the wide distribution of the host make it very probable that the species will be found to have a much wider range than now known. European botanists have excluded the species from the genus.* Through the kindness of the authorities of the University of Illinois I have been permitted to examine material of the species. It is nearest to *R. australis*, but with much more irregularly branched and more flexuose conidiophores, which at first sight suggest those of *Pseudoperonospora Celtidis*.

ON URTICACEAE:

Parietaria pennsylvanica L., Illinois, *Seymour 5302, 5354, 5355*.

TYPE LOCALITY: Southern Illinois, on *Parietaria pennsylvanica* L.

DISTRIBUTION: Illinois.

9. **Rhysotheca viticola** (B. & C.)

Botrytis viticola B. & C.; Berkeley, Jour. Hort. Soc. Lond. **6**: 289. 1851. (Hyponym.)

Botrytis vitis-viticola B. & C.; Taylor, Ann. Rep. U. S. Dep. Agr. **1871**: 110. 1872. (Hyponym.)

Peronospora viticola Caspary, Monatsb. K. Preuss. Akad. Wiss. **1855**: 331. 1855. (Hyponym); de Bary, Ann. Sci. Nat. IV. **20**: 125. 1863.

* A. Fischer; Rabenh. Krypt. Fl. ed. 2. 4^1: 485. 1892. — Berlese, Icon. Fung. Phyc. 41. 1898.

Plasmopara viticola Berl. & De-Toni, in Sacc. Syll. Fung. **7**: 338. 1888.

Hypophyllous, caulicolous, or on young fruits, covering the host with a white downy growth, or causing a brown rot of the fruit without producing aerial hyphae; conidiophores fasciculate, 250–850 × 5–8 μ, 4–5 times branched, the ultimate branchlets about 8 μ long; conidia elliptic-ovate, very variable in size, 9–12 × 12–30 μ; oöspores 30–35 μ; epispore brown, wrinkled, or almost smooth: oögone thin-walled, hyaline or light yellowish-brown.

This is one of the worst fungous pests of the vineyard. It was first collected in the United States by Schweinitz in 1834, and referred to *Botrytis cana* Link. Later Ravenel, Curtiss, and others sent material from South Carolina and New England to Berkeley and de Bary. The first published account of the species which has come to our notice is by Berkeley, who, in publishing a translation of one of Léveillé's papers upon the *Oidium* of the vine, remarks that "a true *Botrytis* of the same section with *Botrytis infestans** but far more beautiful, and highly developed, occurs in South Carolina on vine leaves. I have not, however, heard that it is injurious. My specimens. which were gathered by Mr. Ravenel, and have been named *B. viticola* Berk. and Curt., occurred on *Vitis aestivalis*, and, I believe, on some other species."†

In more recent years mycologists of this and other countries have experienced a decided change of opinion as to the injurious character of the disease. Berlese‡ estimates that 75 per cent. of the crop is destroyed in the northern states by this disease. That this is as extreme a view as the one previously quoted is not improbable, yet that great injury, especially to some varieties, is due to this fungus is certain. The most destructive form is that which occurs on the fruits as a brown rot.

ON VITACEAE:

Parthenocissus quinquefolia (L.) Planch., Alabama, *Underwood;* Minnesota, *Farlow* (N. Am. Fungi *1402*, on "*Ampelopsis quinquefolia*"), *Seymour;* New York *Jackson, 1124.*

---

* *Phytophthora infestans* (Mont.) de Bary.

† Jour. Hort. Soc. London **6**: 289, note. 1851.

‡ Riv. Pat. Veg. **9**: 102. 1902.

Parthenocissus tricuspidata (Sieb. & Zucc.) Planch., New Jersey, *Halsted* (N. Am. Fungi *2427 b*, on "*Ampelopsis Ritchii*," error for the horticultural name *A. Veitchii*).

Vitis aestivalis Michx., Indiana, *Arthur;* Massachusetts, *Grout;* South Carolina, *Ravenel* (Fungi Am. Exs. *61;* Myc. Univ. *617*, on "*V. vinifera*" but subsequently corrected; Fungi Carol. **5**: *90*).

Vitis bicolor Le Conte, New York, *Long.*

Vitis californica Benth., California, *Harkness* (N. Am. Fungi *2247a*).

Vitis cinerea Engelm., Illinois, *Pammel.*

Vitis cordifolia Michx., Indiana, *Olive;* Illinois, *Earle, Hart, Waite;* Missouri, *Jaeger, Trelease;* New York, *Underwood;* Ohio, *Aiken* (Phyc. Prot. *122*); Wisconsin, *Pammel.*

Vitis labrusca L., Connecticut, *Sheldon;* District of Columbia, *Scribner, Williams;* Iowa, *Buchanan, Griffin, Pammel, Stewart, Rolfs, Macbride;* Kansas, *Kellerman* (Funghi Par. Piant. Colt. *102*, on "*Vitis Concord*"; Roum. Fungi Sel. Exs. *5517*, on "*Vitis* cultive var. (*Concord*)"); Massachusetts, *Farlow* (N. Am. Fungi *208*, on "*Vitis* cult."), *Seymour* (Econ. Fungi *3*, on "*Vitis* sp. cult."), *Underwood;* New York, *Blodgett;* Ohio, *Kellerman* (Ohio Fungi *169a*, on "*Vitis* sp. cult."); Pennsylvania, *Ellis;* Wisconsin, *Henry, Pammel, Trelease, Underwood.*

Vitis rotundifolia Michx., Michigan, *Merrow* (Econ. Fungi *3a*, on "*Vitis* sp.").

Vitis vulpina L., Iowa, *Arthur, Hitchcock;* Kansas, *Bartholomew* (Fungi Columb. *2345*); New York, *Jackson 1120, Stevens* (Fungi Columb. *545*, on "*Vitis riparia*"); Ohio, *Kellerman* (Ohio Fungi *169b*); West Virginia, *Sheldon;* Wisconsin, *Clinton, Pammel.*

An additional host, *Vitis vinifera* L., is reported from North America.

TYPE LOCALITY: South Carolina, on *Vitis aestivalis* Michx.

DISTRIBUTION: Coextensive with the grape (*Vitis* spp.) throughout the world.

ICONES: Rep. U. S. Dep. Agr. **1871**: *pl. 4;* Bull. Bussey Inst. **1**: *pl. 2. f. 1, pl. 3. f. 2–8;* Bull. Ill. Lab. Nat. Hist, **1**[1]: *Par. Fungi pl. 2. f. 6, 7;* Rep. U. S. Dep. Agr. **1886**: *Mycol. pl. 1;* Berlese, Icon. Fung. Phyc. *pl. 17, 18.*

10. **Rhysotheca Viburni** (Peck)

Plasmopara Viburni Peck,. Rep. N. Y. State Mus. Nat. Hist. **43**: 74. 1890.

Hypophyllous, affected areas irregular in outline, 3–10 mm. in diam., marginal or following the larger veins, sparingly white-downy, epiphyllous discoloration none to dark reddish-brown or chocolate-colored; conidiophores fasciculate, sparingly 2–3, rarely 4 times branched, 300–600 × 6–8 μ, ultimate branchlets 6–8 μ; conidia broadly elliptic, rarely globose, 15–30 × 12–15 μ, or larger; oōspores unknown.

The present species and the two following ones form a distinct group, and are very closely related; all of them are poorly understood and by no means common in collections. The present species is especially close to *R. ribicola*, from which it differs in its taller conidiophores, its sparser covering and more pronounced discoloration of the host.

ON CAPRIFOLIACEAE:

Viburnum acerifolium L., District of Columbia, *Waite;* West Virginia, *Waite.*

Viburnum dentatum L., New York, *Peck* (cotype), *Thom.*

Viburnum nudum L., Alabama, *Earle* (Phyc. Prot. *81*).

Viburnum Opulus L., Maryland, *Fairchild.*

Viburnum pubescens (Ait.) Pursh, West Virginia, *Waite 721.*

TYPE LOCALITY: Baiting Hollow Station, Long Island, N. Y., on *Viburnum dentatum* L.

DISTRIBUTION: Central New York to Alabama.

11. **Rhysotheca ribicola** (Schrōt.)

Peronospora ribicola Schrōt., Jahrb. Schles. Ges. Vaterl. Kult. **1883**: 139. 1883.

Plasmopara ribicola Schrōt. in Cohn, Krypt. Fl. Schles. **3**[1]: 238. 1886.

Hypophyllous, infected area usually near the main veins, irregular in outline, up to 15 mm., loosely downy, epiphyllous dis-

coloration light and usually not pronounced; conidiophores fasciculate, 200–400 × 7–9 μ, 3–5 times branched, ultimate branchlets 4–8 μ long; conidia elliptic to globose-elliptic, 14–22 × 10–14 μ; oöspores unknown.

This is one of the rarest species of the genus. It is distinguishable from the preceding species by its more conspicuous habit of growth, the smaller conidiophores, and the less pronounced discoloration of the host.

ON GROSSULARIACEAE:

Ribes albinervum Michx., Wisconsin, *Davis* (Fungi Columb. *1753*, on "*Ribes rubrum subglandulosum* Maxim.").

Ribes divaricatum Dougl., Washington, *Piper 2957*.

Ribes hirtellum Michx., Wisconsin, *Davis* (on "*Ribes oxycanthoides* L.").

Ribes prostratum L'Her., Wisconsin, *Davis*.

Ribes rotundifolium Michx., West Virginia, *Sheldon*.

TYPE LOCALITY, Liegnitz, Germany, on *Ribes rubrum* L.

DISTRIBUTION: West Virginia to Washington. Also in Europe.

12. **Rhysotheca Gonolobi** (Lagerh.)

Peronospora Gonolobi Lagerh. Jour. Myc. **7**: 49. 1891.

Plasmopara Gonolobi Swingle, Jour. Myc. **7**: 119. 1892.

Plasmopara Vincetoxici Ellis & Everh. Jour. Myc. **8**: 70. 1902.

Hypophyllous, infected area about 2–5 mm. bounded by the veins, rather well covered with conidiophores, epiphyllous discoloration light-brown; conidiophores fasciculate, 300–600 × 8–10 μ, 4–6 times branched, ultimate branchlets 6–10 μ long; conidia globose-elliptic, rarely elliptic, 16–25 × 13–24 μ, or even larger; "oöspores globose, brown, about 20 μ diam."

The type material of *Peronospora Gonolobi* was collected by Dr. J. H. Mellichamp and sent to Dr. Farlow, who distributed the collection for *Pucinia Gonolobi* Rav., the predominating parasite on the material, and so far as some of the specimens are concerned the only one. Among these latter is the one in the Ellis herbarium. It was, however, possible to determine positively the species of the host which was cited by Lagerheim as *Gonolobus* sp. but which is in reality *Vincetoxicum hirsutum*. The host of *Plasmopara Vincetoxici* is also the same species. This discovery led to the conclusion that the two species were the same, a conclusion which

has since been borne out by an examination of authentic material of the earlier species. The present species is easily distinguished from either of the two preceding ones by its larger conidia and more complexly branched conidiophores.

ON ASCLEPIADACEAE:

Vincetoxicum hirsutum (Michx.) Britton, Alabama, *Carver 932*. (Type of *Plasmopara Vincetoxici*.)

Vincetoxicum suberosum (L.) Britton, Florida, *McCulloch*.

An additional host, *V. gonocarpos* Walt., is also recorded.

TYPE LOCALITY: Bluffton, South Carolina, on *Gonolobus* sp. (= *Vincetoxicum hirsutum* (Michx.) Britton).

DISTRIBUTION: Maryland to Florida and Mississippi.

5. PSEUDOPERONOSPORA Rostew. Ann. Inst. Agron. Moscou **9**: 47. Ja 1903. — Flora **92**: 422. O 1903

Plasmopara § *Peronoplasmopara* Berl. Riv. Pat. Veg. **9**: 122. 1901.

Peronoplasmopara Clinton, Rep. Conn. State Agr. Exp. Sta. **29**: 234. 1905.

Mycelium intracellular, branching, haustoria small, usually simple; conidiophores pseudo-monopodially branched, the primary branches arising, as a rule, at acute angles, the ultimate branchlets acute; conidia typically colored, rarely hyaline, elliptic in outline, conspiciously papillate both apically and basally; oöspores thin-walled, smooth or roughened; oögone thin-walled.

Type species, *Peronospora cubensis* B. & C.

The present genus is the most anomalous of the tribe, combining as it does certain characteristics of the present and succeeding tribes. The conidia germinate, as in all species of the *Rysotheceae*, by zoöspores, while the colored conidia suggest a close relationship with *Peronospora*. This is further augmented by the apically acute conidiophores, the method of branching of which is intermediate between the typical method of the two tribes in question.

The close relationship of the two species to each other and their problematical taxonomic position was pointed out by Waite at the time he described the second one.* He, however, allowed them to remain in the genus *Peronospora*. The next step was

* Jour. Myc. **7**: 105. 1892.

taken by Berlese, who formed for them a subgenus under the old genus *Plasmopara*, which he characterized as having the conidiophores of *Peronospora* and the conidia of *Plasmopara*, *i. e. Rhysotheca* of the present treatment of the group. The final step was taken by Rostewzew who made an extensive study of *P. cubensis*, the results of which appeared in an elaborate paper which was published first in Russian and later in German. He concluded that this species represented a distinct genus intermediate between *Peronospora* and *Plasmopara*, *sensu* Schröter. He called the genus *Pseudoperonospora*, choosing this name, as he tells us, rather than *Pseudoplasmopara* as *Peronospora* antedates *Plasmopara*. Later Dr. Clinton made an extended study of the species in America, publishing an admirable paper upon his researches. Unfortunately, at least from a nomenclatural standpoint, he rejected the earlier generic name in favor of Berlese's subgeneric name, and still more unfortunately he has been followed in this by other American mycologists. The name proposed by Rostewzew has more than two years priority over the elevation of Berlese's subgenus to generic rank, and is therefore the rightful name of the genus.

Key to the species

Conidiophores 3–4 times branched.	1. *P. cubensis*.
Condiophores 4–5 times branched.	2. *P. Celtidis*.

1. PSEUDOPERONOSPORA CUBENSIS (B. & C.) Rostew.
Ann. Inst. Agron. Moscou **9**: 47. Ja 1903. —
Flora **92**: 422. O 1903

Peronospora cubensis B. & C. Jour. Linn. Soc. Bot. **10**: 363. 1868.

Plasmopara cubensis Humphrey, Rep. Mass. State Agr. Exp. Sta. **8**: 212. 1891.

Peronoplasmopara cubensis Clinton, Rep. Conn. Agr. Exp. Sta. **1904**: 335. 1905.

Hypophyllous, or rarely amphigenous; discoloration of the host yellowish, rather definite in outline, affected area apparently unoccupied or with a sparse marginal growth; condiophores 1–2, rarely more, from a stoma, 180–400 × 5–9 μ, 3–4, rarely 2–5, times branched, the ultimate branchlets recurved, apically acute, 5–20 μ long; conidia gray, brownish or smoky, ovoid to ellipsoid, papil-

late, 20–40 × 14–25 μ; oöspores spherical, yellowish, watery-papillate, 30–43 μ, maturing in the decaying leaves.

This is one of the most important pests of the truck farmer. Its adaptibility to almost any cultivated species of *Cucurbitaceae* and the comparative immunity of the native species, especially in the more northern states, makes it a pest which is most destructive in regions where Cucurbitaceous vegetables are cultivated in commercial quantities. Its favorite hosts appear to be the cucumber and melon. It has been suggested that the fungus spreads from south to north each season, and in proof of this theory are cited the perennial character of the mycelium in Florida and the records of the distribution of the pest in the southern and eastern states in recent years.* It has also been suggested that hot-house culture of the hosts assists in scattering the disease, at least in the immediate vicinity. It is not impossible that both these factors enter into the distribution of the fungus, while the researches of Rostewzew, who found the immature oöspores in the partially decayed leaves of infested vines, tend to establish the probability that oöspore-production also plays a most important part in the persistency of the pest in infested areas. By the first two means suggested, the distribution of the fungus would of necessity be confined to those regions which could be reached by summer migration and in which hot-house cucurbits were produced. The third method of passing the winter, in addition to the first two, accounts for the occurrence and persistence of the disease in places which, according to the two preceding theories, should be immune from the pest. The problem presented is one of great scientific interest and of a not inconsiderable financial importance to certain sections of the country.

ON CUCURBITACEAE:

Bryonopsis lacunosa erythrocarpa Naud., Ohio, *Selby*.
Citrullus vulgaris Schrad., Louisiana, *Langlois 1122*.
Coccinia indica Wright & Arn., Ohio, *Selby*.
Cucumis angulatus Forsk., Ohio, *Selby*.
Cucumis Melo L., Ohio, *Selby*.
Cucumis odoratissimus Moench, Ohio, *Selby*.

* Bull. S. Car. Agr. Exp. Sta. 116: 7. 1905.

Cucumis sativus L., Florida, *Hume 24;* Massachusetts, *Humphrey;* New Jersey, *Halsted* (N. Am. Fungi *2426a;* Econ. Fungi *41*), *Stevens;* Maryland, *Dorsett;* Ohio, *Selby* (Phyc. Prot. *119*); West Virginia, *Sheldon.*

? *Cucurbita maxima* Duch., New Jersey, *Halsted* (N. Am. Fungi *2426b*).

Cucurbita ovifera L., Ohio, *Duvel.*

Cucurbita Pepo L., Ohio, *Duvel.*

Lagenaria vulgaris Ser., Ohio, *Duvel.*

Micrampelis lobata (Michx.) Greene, Ohio, *Selby.*

Momordica balsamina L., Iowa, *Arthur.*

Mukia scabrella Arn., Ohio, *Duvel.*

The following additional hosts are reported from within our limits: *Cucumis Anguria* L., *Melothria scabra* Naud., *Momordica charantia* L., *Sicyos angulatus* L., *Trichosanthes colubrina* Jacq.

TYPE LOCALITY: Cuba, on some unidentified species of *Cucurbitaceae.*

DISTRIBUTION: New Hampshire to Minnesota, Texas, Florida, and Cuba. Also in South America, Europe, Asia, and Africa.

ICONES: Riv. Pat. Veg. **9**: 125. *f. 21;* Rep. Mass. State Agr. Exp. Sta. **8**: *pl. 2. f. 11–14;* Bull. Ohio Agr. Exp. Sta. 89: *pl. 1;* Rep. Fla. Agr. Exp. Sta. **1899–00**: *pl. 1;* Rev. Myc. **22**: *pl. 203. f. 7–9;* Rep. Conn. Agr. Exp. Sta. **1904**: *pl. 31.*

2. **Pseudoperonospora Celtidis** (Waite)

Peronospora Celtidis Waite, Jour. Myc. **7**: 105. 1892.

Plasmopara Celtidis Berlese, Icon. Fung. Phyc. 16. 1898.

Peronoplasmopara Celtidis Clinton, Rep. Conn. Agr. Exp. Sta. **1904**: 334. 1905.

Hypophyllous, infected areas brownish, limited by the veins, from less than 1 mm. up to covering a large portion of the leaf; epiphyllous discoloration purple with a more or less pronounced yellowish margin; conidiophores scattered, 200–320 × 6–8 μ, 4–5 times branched, the ultimate branchlets straight or slightly recurved, about 5–8 μ long; conidia elliptic, 12–26 × 20–40 μ, smoky or somewhat purplish; oöspores in the leaves, 26–45 μ; epispore thin, yellowish-brown, irregularly thickened; oögone persistent, thin-walled, smooth.

This species is remarkable as the only member of the order

which infests a tree, although a few species occur on shrubs. Perhaps this unusual habitat accounts for the rarity of the species in herbaria.

ON ULMACEAE:

Celtis occidentalis L., District of Columbia,* *Waite 556, 557.*

TYPE LOCALITY: Washington D. C., on *Celtis occidentalis* L.

DISTRIBUTION: Maryland and District of Columbia.

ICON: Jour. Myc. **7**: *pl. 17. f. 1–16.*

NEW YORK BOTANICAL GARDEN.

Studies on the Rocky Mountain flora — XVIII

PER AXEL RYDBERG

Homalobus divergens (Blankinship) Rydb.

Astragalus divergens Blankinship, Mont. Agric. Coll. Sci. Stud. Bot. **1**: 73. 1905.

Homalobus camporum Rydb. Bull. Torrey Club **32**: 666. 1906.

When I described *Homalobus camporum* I overlooked the facts that the same species had already been published by Prof. Blankinship and that he had even cited the type number of my type. He had described the pod, however, as having a stipe, something that I cannot find in any specimens at hand.

Homalobus humilis sp. nov.

Perennial with a cespitose caudex; stems 2–10 cm. long, grayish-strigose, decumbent or spreading; stipules ovate, scarious, 2–3 mm. long; leaves 2–6 cm. long; leaflets 11–15, oblong, 3–6 mm. long, about 2 mm. wide, grayish-strigose beneath, glabrate above; peduncles 2–8 cm. long; raceme short, 1–2 cm. long, 3–8-flowered; calyx strigose with black hairs; tube campanulate, 1.5–2 mm. long; teeth triangular or triangular-subulate, 1–1.5 mm. long; corolla purple, 7–8 mm. long; legume about 1.5 cm. long, 3 mm. wide, widest near the abruptly acute apex, tapering towards the base, the upper suture nearly straight, the lower strongly arched at the apex.

This species most resembles *H. divergens* (Blankinship) Rydb. in habit, but differs in the shape of the legumes, the darker corollas, and in the less canescent leaves, which are glabrate above. It grows on high arid mountain tops at an altitude of nearly 3,000 m.

UTAH: Mountain north of Bullion Creek, near Marysvale, 1905, *Rydberg & Carlton 7147* (type); Delano Peak, 1905, *nos. 1219* and *1219 a*.

Homalobus microcarpus sp. nov.

Homalobus campestris Rydb. Bull. Agr. Exp. Sta. Col. **100**: 209, in part. 1906. Not *H. campestris* Nutt.

Homalobus camporum Rydb. *loc. cit.*, in part.

Perennial with a cespitose caudex; stems decumbent, about 1 dm. high, strigose; leaves 5–8 cm. long; stipules ovate, scarious, 2–3 mm. long; leaflets 9–15, elliptic to linear, 5–15 mm. long, 1–3 mm. wide, glabrous above, sparingly strigose beneath; peduncles 4–6 cm. long; racemes short, 3–8-flowered; calyx strigose with black hairs; tube campanulate, about 2 mm. long; teeth about 1 mm. long, subulate; pod sessile, strigose, straight, 12–18 mm. long, 3 mm. wide.

This species is intermediate between *H. oblongifolius* Rydb. and *H. divergens* (Blankinship) Rydb. Baker's specimens from North Park were referred to the latter, which the present species resembles in general habit and the pod; but it is a greener plant, the leaflets being glabrous above and only slightly strigose beneath. The smaller size, and the smaller pod of a different shape, separate it from *H. oblongifolius*.

COLORADO: East slope of Rabbit Ear Range, 1894 (type distributed from the State Agricultural College of Colorado, collector not given); Forks of Poudre and Big South, 1894; North Park, 1897, *C. F. Baker;* Steamboat Springs, 1903, *Osterhout 2774*.

Homalobus paucijugus sp. nov.

Perennial with a cespitose caudex, bushy; stems 1–2 dm. high, sparingly strigose; leaves numerous, 5–10 cm. long; leaflets 1–5, the lateral ones lanceolate to linear-subulate, 1 cm. or less long, glabrous above, sparingly strigose beneath, or none; the terminal one 1–2 cm. long, linear or linear-oblanceolate, gradually tapering into the rachis; stipules scarious, ovate, 2–3 mm. long; peduncles 3–6 cm. long; racemes short, 3–6-flowered; calyx strigose with black hairs; tube campanulate, about 2 mm. long; teeth subulate, fully 1 mm. long; legume 12–15 mm. long, 2 mm. wide, straight, strigose.

This species resembles *H. decurrens* in the peculiar terminal leaflet, but differs in the few small and narrow lateral leaflets, the small size of the plant, the small flowers and the small pod. It grows at an altitude of nearly 3000 m.

UTAH: Big Cottonwood Cañon, in sheltered places near the summit of the divide between Lake Solitude and Twin Lakes, 1905, *A. O. Garrett 1580*.

The species confused with *H. tenellus* and usually included in it may be distinguished by the following characters:

Legume glabrous.
Stipe rarely exceeding the tube of the calyx; leaves usually spreading in age; leaflets oblong to oval, obtuse and mucronate. *H. dispar.*
Stipe of the mature legume usually exceeding the calyx-teeth; leaves strongly ascending; leaflets narrowly linear to linear-oblong, mostly acute.
Stipe 3–4 mm. long; leaflets linear or linear-oblong; stem usually conspicuously strigose; calyx-teeth half as long as the tube. *H. tenellus.*
Stipe 5–7 mm. long; leaflets narrowly linear; stem glabrous or nearly so; calyx-teeth usually nearly equaling the tube. *H. stipitatus.*
Legume strigose. *H. strigulosus.*

HOMALOBUS DISPAR Nutt.; T. & G. Fl. N. Am. **1**: 350. 1838.

Orobus dispar Nutt. Gen. **2**: 95. 1818.

This is much less common and has a more restricted range than *H. tenellus.* The range of *H. dispar* includes the extreme western portion of Nebraska, Wyoming, northern Colorado and northeastern Utah, while that of *H. tenellus* extends from Saskatchewan to Nebraska, Colorado, Utah, and the Yukon Territory.

Homalobus stipitatus sp. nov.

Somewhat cespitose perennial; stems slender, 3–4 dm. high, erect, branched, sparingly strigose or glabrate, leafy; leaves strongly ascending, 4–6 cm. long; stipules lance-subulate; leaflets 9–15, narrowly linear, 1–2 cm. long, 1–2.5 mm. wide, glabrous or sparingly strigose beneath; peduncles about 1 cm. long; racemes lax, 2–10 cm. long, 5–20-flowered; calyx strigose; tube campanulate, about 1.5 mm. long; teeth subulate, about as long; corolla ochroleucous, 8–10 mm. long; legume glabrous, stipitate, flat; body oblong, about 1 cm. long, 3 mm. wide, acute, gradually tapering into the stipe, which is 5–7 mm. long.

This species is related to *H. tenellus* (Pursh) Britton [*Astragalus multiflorus* (Pursh) A. Gray], but is a more slender and more glabrate plant, with narrower leaflets and longer stipe. It belongs to the prairie region east of the range occupied by *H. tenellus.*

NORTH DAKOTA: "Upper Missouri" [from the data given in Nicollet's report, on the hills somewhere between Fort Pierre and Devil's Lake], 1839, *Geyer* (type in herb. Columbia University); Valley City, 1897, *L. L. Perrine.*

MINNESOTA: Lake Belmont, Otter Tail Co., 1892, *E. P. Sheldon.*

SASKATCHEWAN: 1858, *E. Bourgeau 4.*

Homalobus strigulosus sp. nov.

Cespitose perennial; stems erect or ascending, branched, 1–3 dm. high, strigulose; stipules short, ovate; leaves 3–4 cm. long; leaflets linear, acute, 8–12 mm. long, 1–2 mm. wide, thick, glabrous above, strigose beneath; peduncles 1 cm. or less; raceme lax, 1.5–3 cm. long, 4–7-flowered; bracts minute, subulate; calyx strigulose; tube campanulate, 1.5 mm. long; teeth subulate, less than 1 mm. long; corolla ochroleucous, about 6 mm. long; pod strigose, shining, stipitate; body oblong, 7–8 mm. long, 3 mm. wide, rather gradually contracted into the stipe, which is about 3 mm. long.

This is closely related to *H. tenellus*, but differs in the smaller flowers and the smaller and hairy pod. It grows at an altitude from 1800–3000 m.

NEVADA: East Humboldt Mountains, 1860, *S. Watson 283* (type).

UTAH: P. V. Junction, Wasatch Mountains, 1883, *M. E. Jones* (mixed with *H. tenellus*).

Diholcos micranthus sp. nov.

Somewhat cespitose perennial; stems erect or ascending, sparingly strigose or glabrate, 2–4 dm. high; stipules ovate, about 5 mm. long; leaves 4–6 cm. long; leaflets 17–25, linear or lance-oblong, acute at both ends, 7–20 mm. long, glabrous above, strigose beneath; peduncles 4–7 cm. long; racemes many-flowered, 3–7 cm. long; calyx strigose; tube campanulate, slightly gibbous, 2–2.5 mm. long; teeth subulate-filiform, 1–2 mm. long, the upper somewhat shorter; corolla 6–7 mm. long, ochroleucous; pod strigose, obsoletely if at all cross-ribbed; stipe 3–4 mm. long; body scarcely 1 cm. long, 3 mm. wide, very acute.

This species is related to *D. Haydenianus* (A. Gray) Rydb. [*Astragalus Haydenianus* A. Gray], differing in the smaller flowers and fruit, the more acute leaflets, the narrower calyx-lobes, and especially the almost total lack of cross-ribs on the more acute legumes. *D. micranthus* was included in *D. Haydenianus* in my Flora of Colorado.

COLORADO: La Veta, 1896, *C. L. Shear 3569* (type); Gunnison, 1896, *Clements 100;* Ridgeway, 1895, *Tweedy 228;* Rio Blanco, south of Pagosa, 1883, *B. H. Smith.*

Kentrophyta minima sp. nov.

Perennial with a woody root and cespitose caudex, forming cushions 1 dm. in diameter; herbaceous stems 1–2 cm. high;

leaves 5–8 mm. long; stipules scarious, lanceolate, 1–3 mm. long, more or less united; leaflets 5–9, linear-lanceolate, conduplicate, pungent, 3–4 mm. long, finely strigose; flowers usually solitary, subsessile; calyx strigose; tube 1–1.5 mm. long, campanulate; teeth subulate, scarcely 1 mm. long; corolla ochroleucous, about 3 mm. long; keel tipped with purple; pod ovoid, rather turgid, acute, 3 mm. long.

This is related to **K. tegetaria** (S. Wats) Rydb. [*Astragalus tegetarius* S. Wats.] and *K. Wolfii* Rydb. From the former it differs in the subsessile flowers and the shorter calyx-lobes; *K. tegetaria* has 1–3-flowered racemes, exceeding the leaves in length and calyx-lobes which are longer than the tube. From *K. Wolfii*, it differs in the appressed pubescence, the smaller flowers and the shorter legume. It is an alpine species growing at an altitude of 2800–3100 m.

YELLOWSTONE NATIONAL PARK: August 1884, *Tweedy 83* (herb. Columbia Univ.).

Aragallus patens sp. nov.

Acaulescent perennial; leaves spreading or ascending, 5–10 cm. long; leaflets 9–17, elliptic or oblong, acutish at both ends, 1–2 cm. long, 4–6 mm. wide, somewhat silvery with closely appressed hairs; scape 1–1.5 dm. high, strigose with short silky hairs; raceme short, 3–7 cm. long; bracts linear-lanceolate to lanceolate, 5–8 mm. long; flowers usually spreading; calyx sparingly appressed-silky with short hairs, often somewhat tinged with purple above, 5–6 mm. long, 3 mm. wide; teeth subulate, the upper 2 mm., the lower 3 mm. long; corolla dark bluish-purple, about 15 mm. long; banner narrow; wings broad, slightly emarginate, the upper lobes narrow and acutish; keel with a very dark purple spot, and a short, porrect tip; legume ascending-spreading, thin-coriaceous, nearly straight, less than 2 cm. long, 4 mm. thick, long-acuminate, minutely strigose, half 2-celled.

This is related to *A. Lambertii* and *A. sericeus*. From the former it differs in the shorter and broader leaflets and the more spreading leaves; from the latter in being greener, less hairy, and having narrower bracts and calyx-tube and darker flowers, and from both in the smaller size, thinner and more spreading legumes and smaller flowers.

COLORADO: Plains and foothills near Boulder, 1902, *F. Tweedy 5164* (type); between Sunshine and Ward, *no. 5165;* Eldora to

Baltimore, *no. 5634*; Sargents 1901, *C. F. Baker 344*; Cimarron, *no. 277*.

WYOMING: Laramie Plains, 1903, *Goodding 1422*; Centennial, 1900, *Aven Nelson 7680*.

NEBRASKA: Hay Springs, 1901, *MacDougal 44*.

Aragallus angustatus sp. nov.

Acaulescent perennial; leaves spreading or ascending, 6–10 cm. long; leaflets 7–13, narrowly linear-lanceolate to narrowly linear, 1–2 cm. long, 2–4 mm. wide, sparingly strigose; scape about 1 dm. high, sparingly strigose; raceme 3–5 cm. long; bracts lanceolate, about 5 mm. long; calyx finely silky-strigose; tube 5–6 mm. long; teeth subulate, about 2 mm. long; corolla purple, 15 mm. long or less; banner rather broad; wings broad and slightly emarginate; keel with a very dark blue-purple spot and a very short porrect tip; legume ovoid, less than 1.5 cm. long, coriaceous, 3.5 mm. thick, rather abruptly contracted into a spreading beak, minutely strigose, half 2-celled.

This resembles, somewhat, a low, narrow-leaved *A. Lambertii*, but differs in the more spreading leaves, and smaller, more spreading flowers, and especially by the short pod, with an abrupt spreading beak. The specimen designated as the type has the best developed fruit.

NEBRASKA: Hills, Rush Creek, 1891, *Rydberg 82c* (fruit, type in herb. Columbia Univ.); prairies, Banner Co., *no. 82a*, in part (fruit); hills, Banner Co., *no. 82b* (flowers); Hay Springs, 1901, *MacDougal 64b* (flowers).

ARAGALLUS BLANKINSHIPII A. Nelson

Prof. J. W. Blankinship * writes:

"*Oxytropis Besseyi* (Rydberg); *Aragallus Besseyi* Rydberg, Flora 250 is *A. Blankinshipii* Nelson, Erythea, **7**: 58. The types of both were collected within a few miles of each other. The fruiting specimens of Nelson were pathogenic, infected with uredo, causing the ovary to remain undeveloped and an abnormal calyx, the legume in the species usually exceeding the calyx; otherwise they are identical."

This statement is only partly correct. Professor Blankinship some time ago sent us specimens of *Aragallus Blankinshipii* from

* Mont. Agr. College Sci. Stud. Bot. 1: 80. 1905.

the type collection. The flowering specimen is identical with my *A. Besseyi*, but the fruiting specimen is not. The flowering specimen has long linear-subulate calyx lobes, 4 mm. long, and linear-lanceolate, acute bracts, while in the fruiting specimen the calyx-lobes are almost triangular and about half as long and the bracts lance-oblong and obtuse. If the fruit of the type sheet is infected by uredo, there is no evidence of it in the duplicate here at the Botanical Garden. The trouble is that *Aragallus Blankinshipii* was described from flowering specimens of one species (*A. Besseyi*) and fruiting specimens of another. They are both well known to me. I intended to describe the second species in the Flora of Montana when in the meantime Professor Nelson's article in Erythea appeared. I had no authentic specimens of his new species. As I knew of no species answering to Professor Nelson's description of *A. Blankinshipii*, never suspecting it to be a composite one, and knowing one agreeing fairly with his description of *A. collinus* except as to the color of the corolla, I referred the specimens of my supposed new species to this. The New York Botanical Garden has since received authentic specimens of both *A. Blankinshipii* and *A. collinus* and I have been able to correct my mistake. The specimens referred to *A. collinus* in my Flora of Montana are specifically the same as the fruiting specimens of *A. Blankinshipii*. Mr. Gooding has also collected good fruiting specimens in Wyoming at Alcona, Natrona County, in 1901 (*no. 147*). These were determined as *A. Blankinshipii*.

This species is closely related to *A. nanus*, differing mostly in the erect stiff scape and more elongated spike. *A. Besseyi*, together with *A. argophyllus*, forms a small group more related to *A. Lambertii*.

I adopt the name *A. Blankinshipii* for this species, represented by the fruiting specimens of the original description for the following reasons: (1) Prof. Nelson has laid most stress on the structure of the pod, associating *A. Blankinshipii* with *A. collinus*, *A. multiceps*, *A. Lagopus* and *A. nanus*, to which this species is related; (2) The characters of the fruit in the genus *Aragallus* are more reliable then those of the flowers to show the actual relationship; (3) The species represented by the flowering specimens has already received a name. The synonymy of the two species is as follows:

ARAGALLUS BLANKINSHIPII A. Nelson Erythea **7**: 58 (fruiting specimens). 1899.

Aragallus collinus Rydb. Mem. N. Y. Bot. Garden. **1**: 254. 1900. Not *A. collinus* A. Nelson 1899.

ARAGALLUS BESSEYI Rydb. Mem. N. Y. Bot. Garden **1**: 250. 1900.

Oxytropis argentata Pursh Fl. Am. Sept. 473. 1814. Not. *O. argentata* Persoon.

Aragallus Blankinshipii A. Nelson. Erythea, **7**: 58 (flowering specimens). 1899.

Aragallus monticolus A. Nelson, Erythea **7**: 62, in part. 1899. Not *Oxytropis monticola* A. Gray.

Oxytropis Besseyi Blankinship, Mont. Agr. Coll. Sci. Stud. Bot. **1**: 80. 1905.

Aragallus atropurpureus sp. nov.

Acaulescent perennial; leaves numerous, 3–7 dm. long; leaflets oval to oblong, canescently silky-villous, 5–15 mm. long, 3–5 mm. wide, obtuse or acute; scape 6–10 cm. long, loosely villous; raceme short and headlike; 2–3 cm. long; bracts linear-subulate, 5–10 mm. long; calyx dark, villous with mixed black and white hairs; tube 5 mm. long, 3 mm. wide; teeth black-hairy, subulate, 4 mm. long; coralla dark-purple, about 15 mm. long; wings deeply emarginate; keel with a rather long ascending tip; legume ovoid, less than 1.5 cm. long, 15 mm. thick, abruptly acuminate with a spreading beak, villous, partly black-hairy, thin, half 2-celled.

In pubescence and leaf-form, this species most resembles *A. sericeus*, but it is a much smaller plant, has only half 2-celled, shorter and more curved pod. It is easily distinguished from all the other purple-flowered species of the *A. Lambertii* group by the black-hairy calyx and long calyx-teeth.

WYOMING: Headwaters of Tongue River, Big Horn Mountains, 1898, *F. Tweedy 125* (type, in flower); *no. 126* (in fruit).

Hedysarum utahense sp. nov.

Perennial with a rootstock; stem 4–6 dm. high, finely strigose, stipules triangular, acuminate, 5–8 mm. long; leaves –15 cm. long; leaflets 11–17, elliptic, oval or oblong, usually rounded at both ends, 1–3 cm. long, 5–10 mm. wide, glabrous above, finely

cinereous-strigose or more glabrate beneath; peduncles about 1 dm. long; raceme 4–10 cm. or in fruit even 2 dm. long; bracts ovate to lanceolate, scarious; calyx cinereous-strigose; tube nearly 3 mm. long; teeth lance-subulate, 5 mm. long, attenuate; corolla rose-purple; banner 15–18 mm. long; keel 18–20 mm.; loments minutely strigose; internodes 2–5, 6–8 mm. long, 5–6 mm. wide; nodes narrow, 2.5 mm. or less.

This is related to the subarctic *H. Mackenzii*, from which it differs in the denser pubescence on its calyx, its broader calyx-teeth, its fewer and larger internodes of the loment, its taller habit, broader bracts and lighter and redder flowers. It grows on hillsides at an altitude of 1400–2000 m.

UTAH: Vicinity of Salt Lake City, 1883, *Leonard 55* (type); 1900, *Stokes;* 1869, *Watson 294;* near Ogden, *Coulter;* *Stansbury;* Wahsatch Mountains, 1888, *Dr. Eccles.*

Lathyrus brachycalyx sp. nov.

Perennial with a creeping rootstock; stem simple or slightly branched, 1.5–3 dm. high, usually finely pubescent, sharply 4-angled; stipules semi-sagittate, 5–10 mm. long, 1.5–3 mm. wide, pubescent; rachis 2–5 cm. long, somewhat winged; leaflets 2–5 pairs, linear-oblong or oblanceolate, firm, strongly veined, finely pubescent, acute at both ends, 1–3 cm. long, 2–8 mm. wide; tendrils of the lower leaves reduced to mere tips, those of the upper leaves better developed, but usually simple; peduncles 5–10 cm. long; raceme short, 2-6-flowered; calyx puberulent; tube 4–5 mm. long; upper teeth broadly triangular, scarcely 2 mm. long, the rest lance-subulate, the lowest one 3 mm., rarely 4 mm. long; corolla purple, 2–2.5 cm. long; legume glabrous, 3–4 cm. long, 7 mm. wide.

This species has been confused with *L. decapetalus* and is closely related to it. It differs in the much shorter calyx-tube and calyx-teeth, the broader, more upturned banner, the more pubescent foliage and less well developed tendrils. It grows on hillsides and in cañons and washes at an altitude of 1400–2500 m.

UTAH: City Creek Cañon, 1883, *F. E. Leonard 101* (type), *20* and *29;* 1900, *S. G. Stokes;* 1880, *M. E. Jones 1700;* near Salt Lake City, 1904, *Garrett 998;* 1905, *Rydberg 6162;* Mt. Majestic, *Garrett 1656;* Mount Nebo, 1902, *Goodding 1105;* Wahsatch Mountains, 1869, *S. Watson 295.*

Capnoides hastatum sp. nov.

Glabrous green perennial, 1–1.5 m. high, branched above; leaves 2–4 dm. long, thrice pinnatifid; ultimate divisions elliptic or oval, 1–2 cm. long, mucronate; racemes 1 dm. long or more; bracts oblanceolate, about 1 cm. long; pedicels about 3 mm. long; sepals narrowly hastate with broad often toothed, divergent basal lobes, about 2 mm. long; corolla with the spur 15–18 mm. long, salmon-pink; hood scarcely crested.

This species is closely related to *C. Cusickii* (S. Wats.) Heller, but differs in the smaller corolla, less crested hood and the sepals which are hastate instead of reniform and laciniate.

IDAHO: Lolo Creek, 1902, *C. V. Piper 4057* (type in herb. N. Y. Bot. Garden).

Capnoides brachycarpum sp. nov.

Glabrous and glaucous perennial with thick root; stem 3–6 dm. high, branched above; leaves 2–3 dm. long, thrice pinnatifid; ultimate divisions lanceolate or lance-elliptic, 2–3 cm. long, 5–12 mm. wide; racemes 1–2 dm. long, the upper often branched; bracts linear-subulate, about 5 mm. long; pedicels ascending, about 5 mm. long; sepals ovate, acute, 2–3 mm. long with toothed auricles at the base; corolla, including the spur, about 15 mm. long, yellowish, the inner petals tipped with purple or brown; spur about the length of the body of the petals, horizontal; crest of the hood obsolete; pod horizontal or reflexed, obovoid, about 1 cm. long and 6 mm. wide.

This species was included in the original description of *Corydalis Brandegei* S. Wats., but the type of the latter and all Colorado specimens can easily be distinguished by the green, scarcely glaucous foliage, the broader oval or obovate mucronate divisions of the leaves, the broader and obtuse sepals, the longer corolla, which is fully 2 cm. long and has an almost erect spur, and the fruit, which is fully 1.5 cm. long but scarcely more than 4 mm. thick. *C. brachycarpum* grows along streams at an altitude of nearly 3000 m.

UTAH: Alta, 1879, *M. E. Jones 1197* (type in herb. N. Y. Bot. Gard.); 1905, *Rydberg 6848;* Silver Lake, American Fork Cañon, 1895, *M. E. Jones;* Wahsatch Mountains, 1884, *Leonard 175.*

Lepidium Crandallii sp. nov.

L. Jonesii Rydb. Bull. Ag. Ex. Sta. Colo. **100**: 152, in part. 1906.
L. Eastwoodiae Rydb. *l. c.* in part.

Perennial; stems several, branched and leafy throughout, glabrous or puberulent above, 3–5 dm. high; basal leaves and lower stem-leaves pinnatifid, 5–7 cm. long, glabrous, with oblanceolate or oblong, entire or slightly toothed divisions; upper stem-leaves, especially those of the branches, oblanceolate or linear, entire or toothed; sepals oblong, nearly 2 mm. long, white-margined; petals clawed, about 3 mm. long, white, their blades obovate; stamens 6; fruiting racemes 5–10 cm. long; pedicels divergent; pods oval or ovate, about 4 mm. long, glabrous, slightly wing-margined above; style 1 mm. long, about twice as long as the wing-margin.

This species is related to the two species to which it has been referred and to *L. allyssoides*. From the latter and *L. Eastwoodiae* it differs in the more commonly dissected stem-leaves, the broader and shorter segments of the leaves and the comparatively longer style. From *L. Jonesii* it differs in the broader leaf-segments, thinner leaves, and more branched habit. From *L. scopulorum* it differs in the less woody base, the branched and leafy stem, thinner leaves and shorter styles.

COLORADO: Palisades, May 14, 1898, *Crandall 131* (type in herb. N. Y. Bot. Gard.); Glenwood Springs, 1902, *Osterhout 2599*;

Lepidium brachybotryum sp. nov.

Biennial or perennial with a tap-root; stem 2–3 dm. high, branched, puberulent throughout; basal leaves puberulent, bipinnatifid, about 5 cm. long, with elliptic or obovate lobes; stem-leaves oblanceolate, pinnatifid or toothed; sepals oblong, about 1 mm. long, white-margined; petals white, clawed, 2 mm. long, their blades broadly obovate; stamens 6; fruiting racemes short, 2–5 cm. long; pedicels divergent, 5–7 mm. long; pod rounded-ovate, 3 mm. long, 2.5 mm. wide, wing-margined above; styles less than 0.5 mm. long, scarcely exceeding the wing-margins.

This is related to *L. montanum* but differs in the short style, more rounded pods, and short racemes. It grows on sage-brush flats.

UTAH: Juab, 1902, *Goodding 1075* (type in herb. N. Y. Bot. Gard.); Wasatch County, near Midway, *Carlton & Garrett 6728* (poor specimen doubtfully referred here).

Lepidium Fletcheri sp. nov.

Annual or biennial; stem erect, 3–5 dm. high, puberulent with short cylindric spreading hairs, branched above with ascending branches; leaves narrow, pinnatifid with linear divisions or saliently toothed, 2–5 cm. long, puberulent; those of the inflorescence linear and entire; sepals oblong, scarcely 1 mm. long, green, with white margins; petals none; stamens usually 2, scarcely exceeding the sepals; fruiting racemes 3–5 cm. long; pedicels 4 mm., terete; pod glabrous, scarcely 3 mm. long, obovate in outline, glabrous, strongly wing-margined above; lobes of the wings nearly 0.5 mm., triangular-ovate, acutish or obtuse; seed 1 mm. long, brown, wingless.

This species is related to *L. densiflorum* and *L. ruderale*, but differs from both in the deeper, more open notch of the pod and the prominent lobes of the wing. From the former it differs also in the smaller pod and the narrow divisions of the leaves and from the latter in the leaves, of which none, apparently, are bipinnatifid. In the fruit it resembles *L. Bourgeauanum* Thelling, but differs in the simple erect habit and in the pinnatifid leaves.

MANITOBA: Roadsides, Winnipeg, 1905, *J. Fletcher* (type in herb. N. Y. Bot. Gard.); apparently also

SASKATCHEWAN: Cherryfield, 1906, *Macoun & Herriot 69881*.

THELYPODIUM Endl.

This genus as treated in the Synoptical Flora represents at least half a dozen different types of plants. Whether they should be regarded as one or more genera depends upon the individual tastes and inclinations of the botanist treating them. Dr. Greene, in splitting up the genus *Streptanthus*, expressed the opinion that either these two genera, *Stanfordia* and *Caulanthus*, should be united into one, or else *Streptanthus* should be divided into several. The writer agrees so far with Dr. Greene and thinks that *Thelypodium* and *Caulanthus* should be treated the same way. He has not been able to follow Dr. Greene in his segregation, however, partly because he does not know well enough the West American species treated by Dr. Greene, and partly because his opinions differ considerably in some cases. One of these cases will be given below.

Thelypodium was established by Endlicher, and based wholly

on *Pachypodium* Nutt.* A generic diagnosis was given but no species were cited. In Walpers' Repertorium (1 : 172), the genus was again taken up and the three species of *Pachypodium* found in Torrey and Gray's Flora, were taken up in the same order as these. Hence *Thelypodium* is a mere substitute for *Pachypodium*, which name had been used for another genus, and the type of the latter genus is the type of the former. The three species of *Pachypodium* are the following, given in the order in which they appear: *P. laciniatum*, *P. integrifolium*, *P. sagittatum*. The last of the three need not be considered, for in Torrey and Gray's Flora it is regarded as doubtfully belonging to the same genus as the preceding and perhaps belonging to a section of *Arabis*. The type of *Pachypodium* Nutt., and hence of *Thelypodium* Endl., must then be either *P. laciniatum* or *P. integrifolium*. There is nothing that points directly to either of the two, but everything favors the former. It is not only the first species mentioned, but it is also the only one previously known and figured. It was first described as *Macropodium laciniatum*. Hooker compared it with the original *M. nivale*, gave figures for both and emphasized the differences between the two, the oblong anthers and the long, slender pubescent stipe of *M. nivale* and the linear anthers and the short, stout stipe of *M. laciniatum*. Nuttall remarked "evidently not a *Macropodium*." It is evident that he selected the name *Pachypodium* from the short, stout stipe.

If *Macropodium laciniatum* Hook. is regarded as the type of *Thelypodium* Endlicher, and the writer can not regard it otherwise, the closest relatives of it we find in *T. utahense* Rydb. and the groups of *Thelypodia* on which Dr. Greene based his genus *Guillenia*. It is hard to see how *Thelypodium lasiophyllum* Greene, the type of the latter genus, can be generically distinct from *T. laciniatum* (Hook.) Endl. Every character pointed out by Dr. Greene for his *Guillenia* agrees with the latter and is even found in Hooker's description. It will be admitted that there are some habitual differences, by which *T. laciniatum* is isolated from *Guillenia*, but *T. utahense*, originally named *T. laciniatum*, has the habit of that genus, while the flower and fruit are essentially those of *T. lasiophyllum*.

* T. & G. Fl. N. Am. 1 : 96. 1838.

Dr. Greene evidently intended to include in *Guillenia*, *Arabis longirostris* or *Streptanthus longirostris*, but in enumerating the species of his new genus he has no *G. longirostris*. He has one *G. rostrata* based on *Arabis rostrata* S. Wats., a name the publication of which I have been unable to find. *Arabis longirostris* is hardly congeneric with *Telypodium lasiophyllum*, however. It has the flat pod of *Streptanthus*, but the short anthers, merely cordate at the base, and not spirally curved, place it as very doubtfully belonging to any of the Streptanthoid genera.

The second species of *Pachypodium* in Torrey and Gray's Flora, now usually known as *Thelypodium integrifolium* (Nutt) Endl., is so different in habit, that the writer has always found it hard to regard it as congeneric with the rest, but the differences in the structure of the flower and of the pod externally are so slight that a segregation based on habit alone would not be desirable. There is however, a character in the pod, unique to this species and two or three segregates from it and making them stand isolated from all the other Thelypodioid plants, viz., the strong and broad midrib of the septum of the pod. There is no distinct midvein in any of the typical *Thelypodia*.

A species closely resembling *T. integrifolium* in habit, foliage and flowers, is *T. linearifolium* or *Iodanthus* or *Streptanthus linearifolius*, but it lacks the rib on the septum. Besides it has two characters not found in the other *Thelypodia*. Two of the rather firm and purple sepals are strongly saccate at the base and the stigma is conical, not truncate nor 2-lobed as in the other species. It could be referred to *Hesperis*, which it resembles especially in the flowers, if it were not for the stipitate, terete pod and the curved anthers, which characters are strongly thelypodioid.

In describing the subgenus *Euthelypodium* in the Synoptical Flora, Dr. Robinson gives *T. elegans* Jones as an exception having a 2-lobed stigma with the lobes expanding over the septum. In the whole tribe the stigma is either undivided or else the lobes are expanded over the valves. This exceptional character is most pronounced in the species mentioned above, but it is also found in less degree in *T. aureum* Eastw. and *T. Bakeri* Greene. Mr. George Osterhout, of New Windsor, Colorado, who has collected a specimen of *T. elegans*, has written on the label: "near to

Streptanthus wyomingensis A. Nelson but probably rather a *Thelypodium*." This note made the writer compare the latter species. When *S. wyomingensis* was first described, it was thought that it was the closest relative of *S. maculatus* Nutt., the only original *Streptanthus*, but a closer comparison now has shown that the pod is not flat as in *Streptanthus* and the lobes of the stigma are turned the wrong way. Its relationship is with the three *Thelypodia* just mentioned above, with which it also agrees in habit.

Two other species of *Thelypodium* are said by Dr. Robinson to have the lobes of the stigma placed in the same way, viz.: *T. micranthum* and *T. longifolium*, but here that character is scarcely noticeable. There are other characters in which they disagree with the other *Thelypodia*. The branched or stellate pubescence is unique in the whole tribe and should place them according to the classification used in Engler & Prantl's Pflanzenfamilien in another grand division of the family. The stamens and the pods are, however, more or less thelypodioid. In both species the flowers are more or less irregular, the lower sepals being longer (this is best shown in *T. longifolium*) and there is scarcely any distinction between claw and blade in the petals.

The most interesting of the *Thelypodia* is perhaps *T. Wrightii*. In the pod, the texture of sepals and petals, the form of the latter, etc., this is close to the typical *Thelypodia*. The habit is not so essentially different either, but the sepals are spreading-reflexed and early deciduous as in *Stanleya* and the glands at the base of the stamens and the thickening of the pedicel, both so conspicuous in most thelypodioid plants, are here inconspicuous. The plant could not be included in *Stanleya*, on account of the short stipe, the different habit and the structure of the petals.

The genera may be distinguished as follows:

Sepals equal or nearly so; hairs simple or none.
- Sepals erect or ascending in anthesis.
  - Stigma distinctly lobed, its lobes expanded over the septum. *Thelypodiopsis.*
  - Stigma entire or, if indistinctly lobed, the lobes expanded over the valves.
    - Stigma truncate; sepals scarcely gibbous at the base.
      - Septum of the pod without a distinct midrib. *Thelypodium.*
      - Septum of the pod with a strong midrib. *Pleurophragma.*
    - Stigma conical; the outer sepals gibbous at the base. *Hesperidanthus.*
- Sepals strongly spreading or reflexed in anthesis, soon deciduous. *Stanleyella.*

Sepals unequal, the lower longer; hairs, at least some of them, stellate or branched, *Heterothrix.*

THELYPODIOPSIS gen. nov.

Biennials with rather thick and glaucous foliage and glabrous except the lower part of the stem. Basal leaves spatulate or oblanceolate, more or less toothed, with winged petioles; stem-leaves auriculate-clasping with rounded auricles. Sepals thin, erect or ascending, not gibbous, more or less petaloid, linear or oblong. Petals more or less clawed, white or purplish or in one species yellow. Filaments distinct, slender, filiform or subulate; anthers long, linear, sagittate at the base, soon spirally curved. Pod slender, terete, more or less torulose, usually with short stipe and style; stigma 2-lobed, the lobes expanded over the septum; cotyledons obliquely incumbent.

The first species of this genus as well as of the following new genera is regarded as the type.

Stipe very short, less than 1 mm. long or almost none; petals white or tinged with purple.
Style 2 mm. or nearly so.
Pod 7–9 cm. long. *T. elegans.*
Pod about 4 cm. long. *T. Bakeri.*
Style less than 1 mm. long; pod 5–7 cm. long. *T. wyomingensis.*
Stipe 2–5 mm. long; petals and sepals yellow. *T. aurea.*

Thelypodiopsis elegans (M. E. Jones).

Thelypodium elegans M. E. Jones, Zoe **4**: 265. 1893.

Thelypodiopsis Bakeri (Greene).

Thelypodium Bakeri Greene, Pl. Baker. **3**: 8. 1901.

Thelypodiopsis wyomingensis (A. Nelson).

Streptanthus wyomingensis A. Nelson, Bull. Torrey Club **26**: 126. 1899.

Thelypodiopsis aurea (Eastw.).

Thelypodium aureum Eastw. Zoe **2**: 227. 1891.

Thelypodium Palmeri sp. nov.

Biennial or perennial with a tap-root; stem 3–5 dm. high, sparingly hirsute below, glabrous above; basal leaves oblanceolate or spatulate, 2–4 cm. long, more or less hirsute beneath, especially on the veins; stem-leaves sagittate, 2–4 cm. long, glabrous or nearly so; inflorescence usually branched with ascending branches; pedicels nearly erect, 5–8 mm. long; sepals oblong, 3–4 mm. long; petals 5–6 mm. long, white or rose; claw about 3 mm. long; blade spatulate or oblanceolate; pod about 2–5 cm. long, 1 mm. wide.

This species has been confused with *T. sagittatum* (Nutt.) Endl., but differs in the smaller and narrower petals, nearly erect pedicels and narrow pod.

SOUTHERN UTAH: 1877, *E. Palmer 25* (type in herb. Columbia Univ.).

Thelypodium leptosepalum sp. nov.

Annual or biennial, glabrous throughout; stem 4–6 dm. high, branched; leaves thin, glabrous, 6–10 cm. long, lyrate-pinnatifid with lanceolate divergent lobes; flowering pedicels about 3 mm. long; sepals lance-subulate, 6 mm. long, 1–1.5 mm. wide at the base, white; petals narrowly linear-oblanceolate, almost strap-shaped, with scarcely any distinction between blade and claw, 8 mm. long, 0.5 mm. wide or less; filaments filiform, about 1 cm. long when well developed; anthers linear, sagittate at the base, soon curled.

This is closely related to *T. laciniatum* (Hook.) Endl., but differs in the narrow tapering instead of oblong sepals. It grows at an altitude of 450–600 m. on rocky banks.

IDAHO: Lewiston, Nez Perces County, 1896, *A. A. & E. Gertrude Heller 3022* (type in herb. Columbia Univ.); Valley of Peter Creek, Nez Perces County, 1892, *Sandberg, MacDougal & Heller 122.*

PLEUROPHRAGMA gen. nov.

Tall glabrous perennials or biennials with paniculate inflorescence and thick entire leaves. Basal leaves oblanceolate or spatulate; stem-leaves linear-lanceolate, sessile but not clasping. Sepals ascending, thin, more or less petaloid. Petals white or purplish with slender claws. Filaments distinct, subulate, white, somewhat dilated below and with conspicuous glands at their bases; anthers linear, sagittate at the base, curved. Receptacle dilated. Pod slender, terete, torulose, tapering at both ends into a short stipe below and a short slender style above; stigma minute, entire; septum with a strong midrib.

Pleurophragma integrifolium (Nutt.)

Eachypodium integrifolium Nutt.; T. & G. Fl. N. Am. 1: 96. 1838.

Thelypodium integrifolium Endl.; Walp. Rep. 1: 172. 1842.

Pleurophragma gracilipes (Robinson)

Thelypodium integrifolium gracilipes Robinson, Syn. Fl. 1[1] 176. 1895.

Pleurophragma platypodum sp. nov.

Glabrous perennial with a tap-root; stem simple up to the inflorescence, 1–2 m. high; basal leaves spatulate, 5–10 cm. long, entire; stem-leaves 3–6 cm. long, linear-lanceolate or oblanceolate, dark-green, thick; inflorescence paniculate; racemes dense, at first corymbiform, in fruit about 1 dm. long; sepals oblong, yellowish- or greenish-white, 4 mm. long; petals white, clawed, 6–7 mm. long; blades spatulate; pedicels in fruit about 3 mm. long, divergent or somewhat reflexed, dilated and flattened at the base, pod 1.5–2 cm. long, 1–1.5 mm. thick, torulose; stipe 1–2 mm. long; style short.

This is related to *Pleurophragma integrifolium* (*Thelypodium integrifolium* Endl.), but differs in the shorter inflorescence, the shorter pedicels, broadened at the base, the shorter pod with longer stipe and shorter style.

UTAH: Moab, 1891, *M. E. Jones* (labeled *Thelypodium Wrightii*, type in herb. N. Y. Bot. Garden).

ARIZONA: 1876, *E. Palmer*.

To this genus belongs also *Thelypodium lilacinum* Greene, Pl. Baker. **3**: 9. 1901, if distinct from *T. integrifolium*. The only specimens at hand differ from that only in the stronger purple color of calyx and corolla. They are without fruit, which, however, may furnish distinctive characters.

HESPERIDANTHUS (B. L. Robinson) Rydb., gen. nov.

Thelypodium § *Hesperidanthus* B. L. Robinson, Syn. Fl. **1**[1]: 174. 1895.

Erect, slender, glabrous perennials, with pale foliage; corymbosely branched above. Basal leaves obovate, toothed; stem-leaves linear, entire. Sepals rather firm, erect; the outer strongly saccate at the base. Petals purple, with obovate blades. Anthers linear, sagittate at the base, strongly curved. Stigma conical or ovate, neither truncate nor 2-lobed. Pod terete, linear, short-stipitate.

Hesperidanthus linearifolius (A. Gray).

Streptanthus linearifolius A. Gray, Pl. Fendl. 7. 1849.

Iodanthus or *Pachypodium linearifolium* A. Gray, Proc. Am. Acad. **6**: 187. 1863.

Thelypodium linearifolium S. Wats. Bot. King's Expl. 25. 1871.

STANLEYELLA gen. nov.

Tall branched biennials. Leaves thin, the lower ones lyrately pinnatifid, the upper entire. Sepals thin, petaloid, white, oblong or linear, spreading or even reflexed in anthesis. Petals white, with oblanceolate or spatulate blades gradually tapering into a short claw. Filaments distinct, filiform; anthers linear, sagittate at the base, soon more or less spirally recurved. Pod slender, terete with short stipe and short style; stigma small, truncate or nearly so; cotyledons incumbent and somewhat conduplicate.

Stanleyella Wrightii (A. Gray)

Thelypodium Wrightii A. Gray. Pl. Wright. 1: 7. 1852.

HETEROTHRIX (B. L. Robinson) Rydb., gen. nov.

Thelypodium § *Heterothrix* B. L. Robinson, Syn. Fl. 1[1]: 178. 1895.

Slender biennials, more or less pubescent at least below with stellate or branched hairs. Basal leaves oblanceolate, more or less toothed; stem-leaves lance-linear or linear, entire. Racemes elongated, slender. Calyx more or less oblique, the lower sepals being longer than the upper, all ascending, rather firm and more or less purplish. Petals oblanceolate or spatulate, indistinctly or broadly clawed. Filaments subulate, broad at the base, distinct, scarcely exserted; anthers linear, sagittate at the base, spirally curved. Pod slender, terete, sessile; stigma minute, entire or slightly lobed, the lobes expanding over the septum; cotyledons obliquely incumbent.

Heterothrix longifolia (Benth.)

Streptanthus longifolius Benth. Pl. Hartw. 10. 1839.
Thelypodium longifolium S. Wats. Bot. King's Expl. 25. 1871.

Heterothrix micrantha (A. Gray)

Streptanthus micranthus A. Gray Pl. Fendl. 7. 1849.
Thelypodium micranthum S. Wats. Proc. Am. Acad. 17: 321. 1882.

CHLOROCRAMBE gen. nov.

Perennial glabrous herbs; stem simple at least up to the inflorescence. Racemes lax with slender horizontal or reflexed pedicels. Leaves thin, petioled, with usually hastate blades. Sepals greenish, ascending. Petals greenish-white, with short claws and lanceolate dentate blades. Anthers sagittate at the

base, linear-oblong, at last curved, greenish. Pod slender, somewhat torulose, short-stipitate and short-styled; stigma minute, entire.

The plant referred here has been included in *Caulanthus*, but the type of that genus, *C. crassicaulis*, and its allies have an urn-shaped, more or less closed calyx; linear, oblong, or spatulate petals, which have practically no claws, are thin and membranous except the upper third or fourth, which is thicker, brownish or purplish, curved and crisp; and a conspicuous, two-cleft stigma.

Chlorocrambe hastata (S. Wats.) Rydb.

Caulanthus hastatus S. Wats. Bot. King's Expl. 28. 1871.

Sophia magna sp. nov.

Annual; stem branched, 5–10 dm. high, sparingly stellate-puberulent or glabrous, stout; basal leaves twice to thrice pinnatifid, 1–2 dm. long, nearly glabrous; segments obovate, often toothed; stem-leaves similar but with narrower segments; sepals yellow, 2 mm. long, oblong; petals spatulate, nearly 3 mm. long, rather light-yellow; pedicels in fruit 15–20 mm. long, ascending; pod glabrous, more or less clavate, 12–15 mm. long, 1.5–2 mm. thick; seeds more or less in two rows.

This species is related to *S. intermedia* and *S filipes*, but differs from both in the broad segments of the basal leaves. In habit it therefore resembles *S. incisa*, but has an evidently clavate pod. It has the conspicuous flowers of *S. filipes*, but the terminal segment of the leaves is not elongated. It was first mistaken for *S. brachycarpa*; but the style is evident although short. It grown on river-bluffs at an attitude of 1500–2500 m.

COLORADO: North of La Veta, 1900, *Rydberg & Vreeland 6163* (type in herb. N. Y. Bot. Gard.); South of La Veta, *6162*; Plains near Denver, *6164*.

Sophia Nelsonii sp. nov.

Slender annual; stems 2–4 dm. high, slightly stellate or glabrate; leaves pinnatifid or bipinnatifid with linear or oblong divisions, slightly stellate or glabrate; sepals oblong, 1 mm. long; petals light-yellow, spatulate, 1.5 mm. long; fruiting pedicels ascending, 4–6 mm. long; pods clavate, 5–8 mm. long, glabrous, slightly over 1 mm. thick; style minute.

This species is probably nearest related to *S. intermedia*, but

differs in the shorter pod and pedicels and the smaller flowers. From *S. pinnata* it differs in being nearly glabrous and by the shorter pedicels and the erect pods. It grows on gravelly flats, sandy plains and rocky hills, at an attitude of 1300–2000 m.

WYOMING : Wraith Falls, Yellowstone Park, 1899, *Aven Nelson & Elias Nelson 5710* (type in herb. N. Y. Bot. Gard.); Green River. 1895, *Rydberg*; Fort Steele, 1901, *Tweedy 4479* and *4480* (?),

UTAH : Salt Lake City, 1884, *Leonard 212*.

Arabis oreophila sp. nov.

Arabis Drummondii alpina S. Wats. Bot. King's Expl. 17, in part. 1871.

Perennial with a more or less branched caudex; stems 1–2 dm. high; basal leaves numerous, broadly oblanceolate or spatulate, stellate-pubescent; stem-leaves rather few, lanceolate, slightly auriculate-clasping; sepals oblong, 3–4 mm. long, margined with purplish, obtuse, glabrous; petals 7–8 mm. long, yellowish-white below, upper portion rose or purplish; pedicels 4–10 mm. long, erect or ascending; pods glabrous, 3–6 cm. long, slightly arcuate, 2 mm. wide, acute, but beak obsolete; seeds in 2-rows, winged above and on one side.

This species is nearest related to *A. Lyallii* S. Wats., and was included therein, but differs in the broader and shorter basal leaves, which are decidedly stellate, and in the pod which lacks a distinct beak. It grows on the higher mountains at an altitude of 2500–3500 m.

UTAH : Divide between Big Cotton-wood Cañon and Heber Valley, 1905, *Rydberg & Carlton 6678* (type in herb. N. Y. Bot. Garden, flowers and young fruit); Alta, 1879, *Jones 1248* (fr.); Uintas, 1869, *Watson 75* (fl.)

WYOMING : Union Peak, 1894, *A. Nelson 1007* (fl.); upper Buffalo Fork, 1899, *C. C. Curtis*.

MONTANA : Old Hollowtop, 1897, *Rydberg & Bessey* (fl.).

NEW YORK BOTANICAL GARDEN.

INDEX TO AMERICAN BOTANICAL LITERATURE
(1907)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions their kindness will be appreciated.

This Index is reprinted monthly on cards, and furnished in this form to subscribers, at the rate of one cent for each card. Selections of cards are not permitted; each subscriber must take all cards published during the term of his subscription. Correspondence relating to the card-issue should be addressed to the Treasurer of the Torrey Botanical Club.

Abrams, L. R. Studies on the flora of Southern California — II. Bull. Torrey Club **34**: 263–265. 10 Jl 1907.

Includes new species in *Chamaebatia*, *Xanthoxalis*, *Malvastrum*, and *Gutierrhezia*.

Bailey, W. W. Lianes. Am. Bot. **12**: 75–77. My 1907.

Bailey, W. W. Wayside flowers. Am. Bot. **12**: 101–103. Je 1907.

Benedict, R. C. Notes on some ferns collected near Orange, New Jersey. Torreya **7**: 136–138. 19 Jl 1907.

Bergen, J. Y. Some ecological observations on the Naples flora. Plant World **10**: 157–161. Jl 1907.

Berger, A. *Pilocereus euphorbioides* Rümpl. Monats. Kakteenk. **17**: 87–91. 15 Je 1907. [Illust.]

Blanchard, W. H. A round-leaved red raspberry. Torreya **7**: 139, 140. 19 Jl 1907.

Rubus Egglestonii sp. nov., native of Vermont.

Brainerd, E. The older types of North American violets.— I. Rhodora **9**: 93–98. 29 Je 1907.

Burlingame, L. L. The sporangium of the *Ophioglossales*. Bot. Gaz. **44**: 34–56. *pl. 3, 4*. 20 Jl 1907.

Campbell, D. H. Studies on the *Ophioglossaceae*. Ann. Jard. Bot. Buitenzorg II. **6**: 138–194. *pl. 9–19*. 1907.

Chamberlain, E. B. *Catharinaea MacMillani.* Rhodora **9**: 98–100. *pl. 74.* 29 Je 1907.

Clute, W. N. *Collinsia verna.* Am. Bot. **12**: 73, 74. My 1907. [Illust.]

Clute, W. N. Our bird's nest fungi. Am. Bot. **12**: 79–81. My 1907.

Cook, M. T. The embryology of *Rhizophora Mangle.* Bull. Torrey Club **34**: 271–277. *pl. 22, 23.* 26 Jl 1907.

Crockett, A. L. *Catharinea crispa* in Maine. Bryologist **10**: 74. 5 Jl 1907.

Cushman, J. A. A synopsis of the New England species of *Pleurotaenium.* Rhodora **9**: 101–106. *pl. 75.* 29 Je 1907.

Dobbin, F. An afternoon in the Helderbergs. Am. Bot. **12**: 78, 79. My 1907.

Dunham, E. M. *Polytrichum gracile* in Maine. Bryologist **10**: 75. 5 Jl 1907. [Illust.]

Edwards, S. C. Why and how to begin study of fungi. Am. Bot. **12**: 97–100. Je 1907. [Illust.]

Fernald, M. L. *Streptopus oreopolus* a possible hybrid. Rhodora **9**: 106, 107. 29 Je 1907.

Fink, B. Further notes on cladonias. XI. *Cladonia pyxidata* and *Cladonia pityrea.* Bryologist **10**: 57–60. *pl. 7.* 5 Jl 1907.

Foslie, M. Algologiske notiser III. Kgl. Norske Vidensk. Selskr. Skr. **1906**[8]: 1–34. 1907.

Includes new American species in *Lithothamnion* (2), and *Lithophyllum* (4), also other American references.

Foslie, M. Antarctic and subantarctic *Corallinaceae.* Wissensch. Ergeb. Schwed. Südpolar-Exped. 1901–1903 **4**[5]: 1–16. *pl. 1, 2.* 1907.

Fritsch, F. E. The subaërial and freshwater algal flora of the tropics. Ann. Bot. **21**: 235–275. Ap 1907.

Based mainly upon Old World observations.

Gager, C. S. The breathing of plants. Jour. N. Y. Bot. Gard. **8**: 143–156. Jl 1907.

Gates, R. R. Hybridization and germ cells of *Oenothera* mutants. Bot. Gaz. **44**: 1–21. *f. 1–3.* 20 Jl 1907.

Guillet, C. Fungi from the Kawartha Lakes (and a few from Toronto) including several new species. Ottawa Nat. **23**: 57–60. 31 Jl 1907.

Several species named as new but not described.

Gürke, M. *Echinocactus gladiatus* Pfeiff. und *E. hastatus* Hopff. Monats. Kakteenk. **17**: 81–86. 15 Je 1907.
Natives of Mexico.

Gürke, M. *Echinocereus Kunzei* Gürke n. sp. Monats. Kakteenk. **17**: 103, 104. 15 Jl 1907.
Native of Arizona.

Harris, C. W. Lichens of the Adirondack League Club tract. Bryologist **10**: 64–66. 5 Jl 1907.

Harshberger, J. W. Observations on the formation of algal paper. Torreya **7**: 141, 142. 19 Jl 1907.

Hemsley, W. B. *Stewartia Malachodendron*. Curt. Bot. Mag. IV. **3**: *pl. 8145*. Jl 1907.
Native of eastern North America.

Hill, A. W. A revision of the geophilous species of *Peperomia*, with some additional notes on their morphology and seedling structure. Ann. Bot. **21**: 139–160. *pl. 15*. Ap 1907.
Includes descriptions of 7 new species, natives of tropical America.

Hill, E. J. The validity of some species of *Fissidens*. Bryologist **10**: 67–74. *pl. 9*. 5 Jl 1907.

Hillier, J. M. Guayule rubber. (*Parthenium argentatum* A. Gray.) Kew Bull. Misc. Inf. **1907**: 285–294. Jl 1907.
Native of Mexico and Texas.

Holm, T. Morphological and anatomical studies of the vegetative organs of *Rhexia*. Bot. Gaz. **44**: 22–33. *pl. 1, 2*. 20 Jl 1907.

House, H. D. Notes on southern violets — II. Torreya **7**: 133–136. *f. 4*. 19 Jl 1907.
Includes *Viola oconensis* sp. nov., a native of South Carolina.

Hutchinson, J. *Montanoa mollissima*. Curt. Bot. Mag. IV. **3**: *pl. 8143*. Jl 1907.
Native of Mexico.

Kirby, A. M. Daffodils, narcissus, and how to grow them as hardy plants and for cut flowers, with a guide to the best varieties. 1–235. *pl. 1–32*. New York, 1907.

Kirkwood, J. E. Some features of pollen-formation in the *Cucurbitaceae*. Bull. Torrey Club **34**: 221–242. *pl. 17–21*. 10 Jl 1907.

Knowlton, F. H. Description of a collection of Kootanie plants from the Great Falls coal field of Montana. Smithsonian Misc. Coll. **50**: 105–128. *pl. 11–14*. 27 Je 1907.
Includes new species in *Cladophlebis*, *Acrostichopteris*, *Dryopteris*, *Adiantum*, *Oleandra*, and *Protorhipis*.

Knox, A. A. The relation of fasciation to injury in the evening primroses. Plant World **10**: 145–151. *f. 29.* Jl 1907.

Kupfer, E. Studies in plant regeneration. Mem. Torrey Club **12**: 195–241. *f. 1–13.* 10 Je 1907.

Lawson, A. A. The gametophytes and embryo of the *Cupressineae* with special reference to *Libocedrus decurrens.* Ann. Bot. **21**: 281–301. *pl. 24–26.* Ap 1907.

Mackenzie, K. K. The range of *Vaccinium virgatum.* Torreya **7**: 144, 145. 19 Jl 1907.

Malme, G. O. A. Några anteckningar om *Victoria* Lindl., särskildt om *Victoria Cruziana* D'Orb. Act. Hort. Berg. **4**[5]: 1–16. *pl. 1–4.* 1907.

Natives of South America.

Mottier, D. M. The development of the heterotypic chromosomes in pollen mother-cells. Ann. Bot. **21**: 309–347. *pl. 27, 28.* Jl 1907.

Murrill, W. A. Leaf blight of the plane-tree. Jour. N. Y. Bot. Gard. **8**: 157–161. *f. 21, 22.* Jl 1907.

Nash, G. V. An attractive Philippine shrub in flower. Jour. N. Y. Bot. Gard. **8**: 161–163. *f. 23.* Jl 1907.

Nash, G. V. Structure and classification of orchids. Jour. Hort. Soc. N. Y. **1**: 24–26. Je 1907.

Nash, G. V. Useful or economic plants. Jour. Hort. Soc. N. Y. **1**: 33–35. Je 1907.

O'Mara, P. Sports. Jour. Hort. Soc. N. Y. **1**: 39–43. Je 1907.

Powell, G. T. The value of selection in the propagation of trees and plants. Jour. Hort. Soc. N. Y. **1**: 36–38. Je 1907.

Purpus, J. A. *Cereus Thurberi* Engelm. Monats. Kakteenk. **17**: 107. 15 Jl 1907. [Illust.]

Native of Mexico and Arizona.

Purpus, J. A. Neue, von Rose beschriebene Kakteen aus Mexico. Monats. Kakteenk. **17**: 91–93. 15 Je 1907.

Quehl, L. Varietäten der *Mamillaria strobiliformis* Scheer. Monats. Kakteenk. **17**: 86, 87. 15 Je 1907.

Natives of Mexico.

Rolfe, R. A. *Odontoglossum Leeanum.* Curt. Bot. Mag. IV. **3**: *pl. 8142.* Jl 1907.

Native of Colombia.

Rolfs, F. M. Die back of the peach trees (*Valsa leucostoma* Pers.). Science II. **26**: 87–89. 19 Jl 1907.

Rose, J. N. Additional notes on Mexican plants of the genus *Ribes*. Smithsonian Misc. Coll. **50**: 32. 1 My 1907.

Ribes madrense Coville & Rose sp. nov.

Rose, J. N. *Cactus Maxonii*, a new cactus from Guatemala. Smithsonian Misc. Coll. **50**: 63, 64. *pl. 6*. 15 Je 1907.

Rose, J. N. & Painter, J. H. *Morkillia*, a new name for the genus *Chitonia*; with description of a new species. Smithsonian Misc. Coll. **50**: 33, 34. 1 My 1907.

Includes description of *Morkillia acuminata* Rose & Painter sp. nov., native of Mexico.

Rydberg, P. A. Linnaeus and American botany. Science II. **26**: 65–71. 19 Jl 1907.

Sargent, C. S. The black-fruited *Crataegus* of western North America. Bot. Gaz. **44**: 64–66. 20 Jl 1907.

Schreiner, O. & Reed, H. S. The production of deleterious excretions by roots. Bull. Torrey Club **34**: 279–303. *f. 1*. 26 Jl 1907.

Shear, C. L. New species of fungi. Bull. Torrey Club **34**: 305–317. 26 Jl 1907.

New species described in *Ozonium*, *Sporotrichum*, *Cladosporium*, *Helminthosporium Phyllosticta*, *Sphaeronema*, *Septoria*, *Sporonema* (2), *Plagiorhabdus* gen. nov. (2), *Leptothyrium*, *Rhabdospora*, *Ceuthospora*, *Bothrodiscus* gen. nov., *Anthostomella*, *Acanthorhynchus* gen. nov., *Gloeosporium*, *Guignardia*, and *Ustilago*.

Sheldon, J. L. The taxonomy of a leaf-spot fungus of the apple and other fruit-trees. Torreya **7**: 142, 143. 19 Jl 1907.

Smith, K. P. Pennsylvania wild flowers. Am. Bot. **12**: 115, 116. Je 1907.

Stapf, O. A new rubber tree: Palo amarillo. (*Euphorbia fulva* Stapf; syn. *E. elastica* Altamirano and Rose, not of Jumelle.) Kew Bull. Misc. Inf. **1907**: 294–296. Jl 1907.

Native of Mexico.

Stapf, O. *Phyllodoce Breweri*. Curt. Bot. Mag. IV. **3**: *pl. 8146*. Jl 1907.

Native of California.

Stejneger, L. The origin of the so-called Atlantic animals and plants of western Norway. Smithsonian Misc. Coll. **48**: 458–513. *pl. 67–70*. 4 My 1907.

Stokey, A. G. The roots of *Lycopodium pithyoides*. Bot. Gaz. **44**: 57–63. *pl. 5, 6 + f. 1*. 20 Jl 1907.

Thériot, I. *Grimmia Dupreti* n. sp. Bryologist **10**: 62–64. *pl. 8*. 5 Jl 1907.

Native of Quebec.

Underwood, L. M. American ferns–VIII. A preliminary review of the North American *Gleicheniaceae*. Bull. Torrey Club **34**: 243–262. *f. 1, 2.* 10 Jl 1907.

Includes descriptions of 4 new species of *Dicranopteris*.

White, J. Atlas of Canada. 1–14. *pl. 1–83.* Ottawa, "1906" [1907].

Includes maps showing distribution of forests and forest trees.

Wittrock, V. B. *Linnaea borealis* L. Species polymorpha et polychroma. *Linnaea borealis* L. En mångformig Art. Act. Hort. Berg. **4**[1]: 1–187. *pl. 1–13* + *f. 1–18.* 1907.

Includes many references to American forms.